POPULAR SCIENCE

MONTHLY

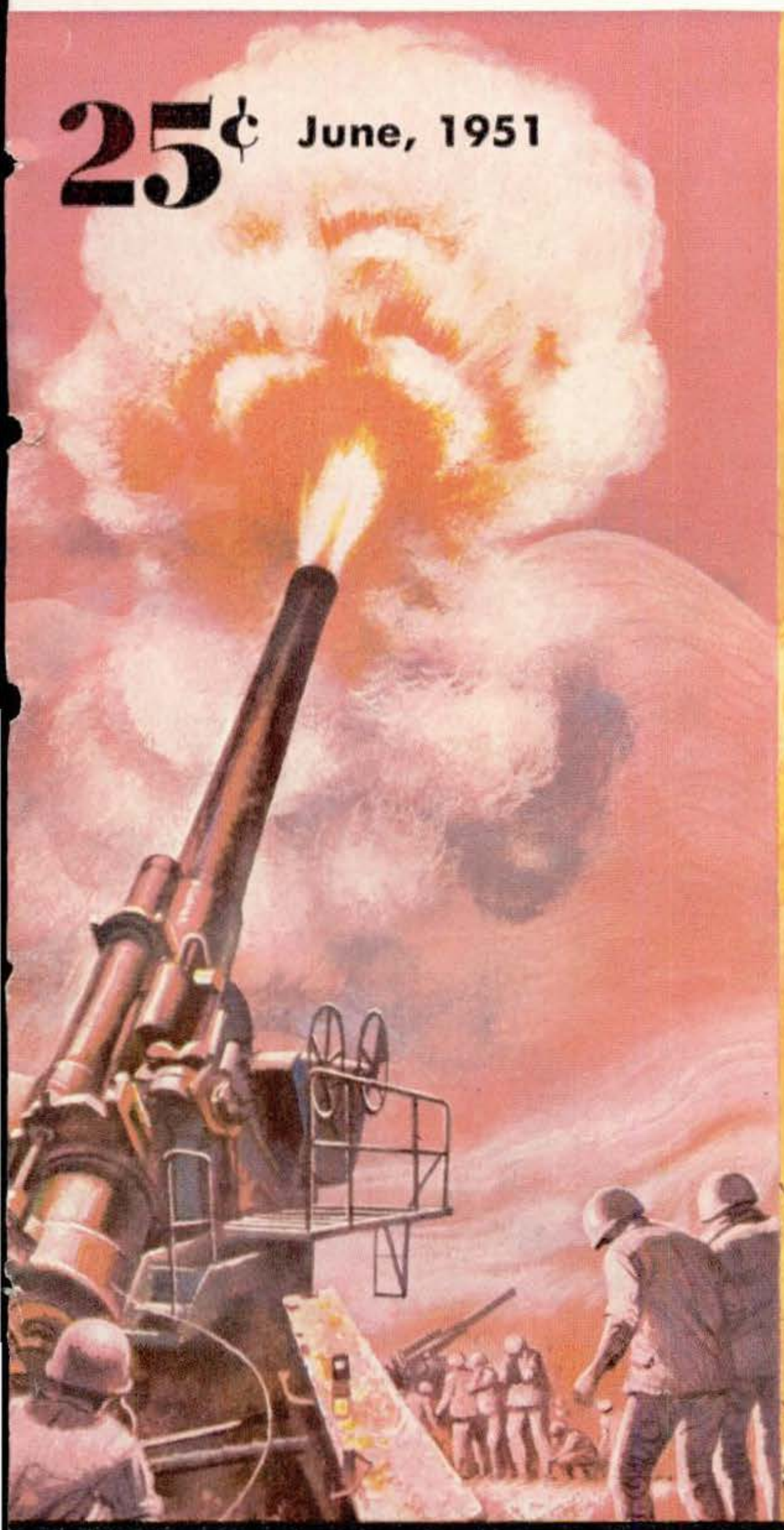
MECHANICS AND HANDICRAFT

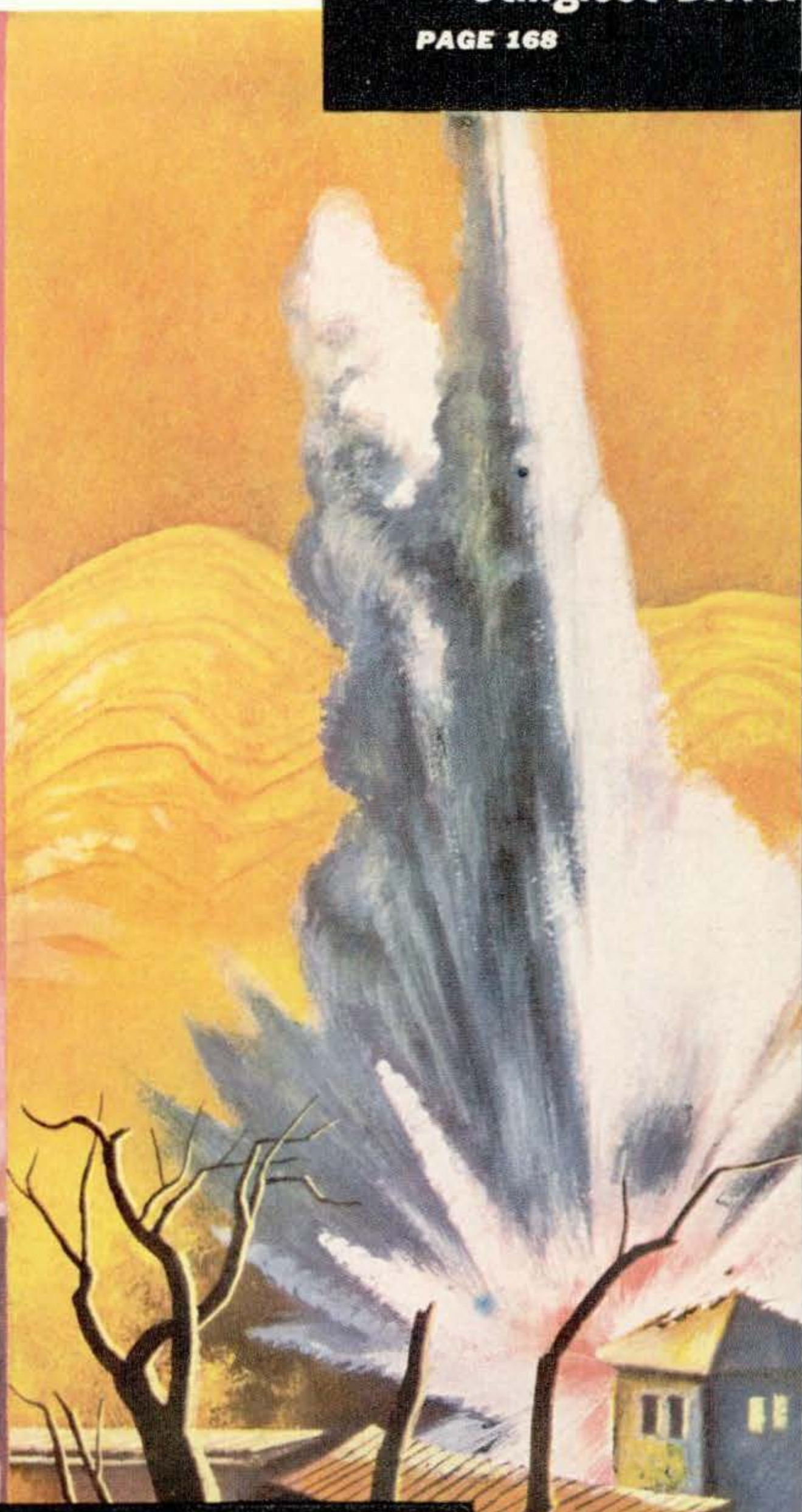
25¢ June, 1951

"How I Save Gas"

—By This Year's Stingiest Driver

PAGE 168





How Gunners Hit an Invisible Enemy

PAGE 78

Paul Hesse photo

Decorative and other specifications subject to change without notice.

Amazingly powered! Attractively priced!

New Studebaker Commander V-8

The eight to buy for thrills and savings!
Advanced V-8 engine needs no premium fuel!

Led only by their Studebaker Champion teammate, two 1951 Studebaker V-8s got better actual gas mileages than all eights and sixes of other makes competing as "standard classification" cars in this year's Mobilgas Economy Run. Studebaker overdrive, optional at extra cost, was used.

SEE THE TOP VALUE OF THE TOP 4 LOWEST PRICE CARS...THRIFTY STUDEBAKER CHAMPION

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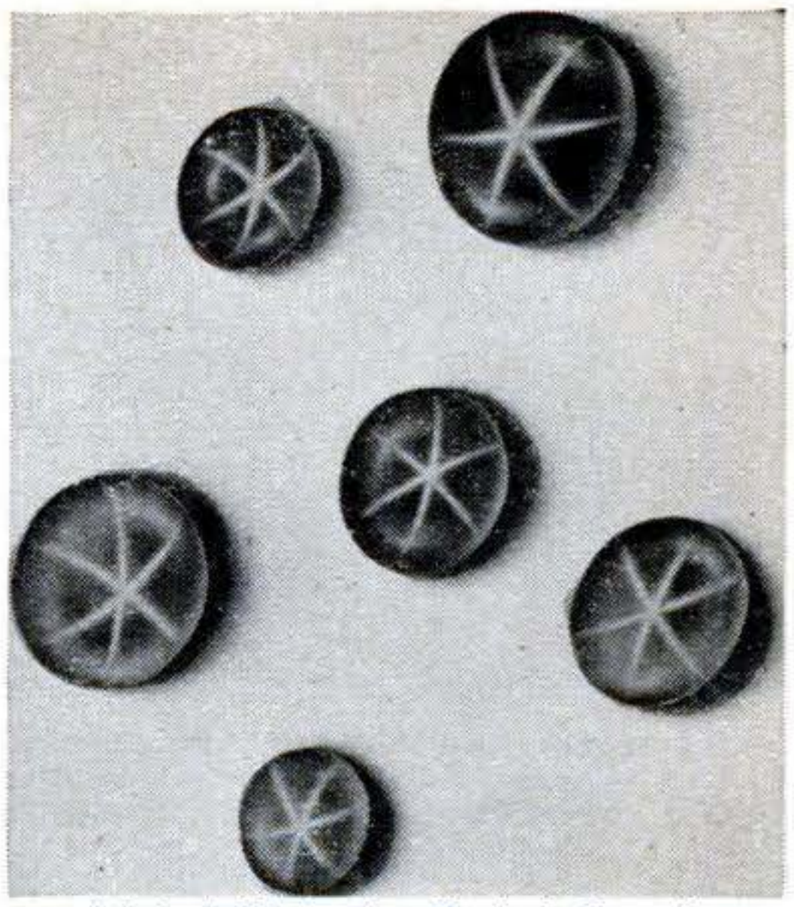
STARS IN YOUR EYES

★ *Announcement* ★

HUDSON GEM COMPANY WISHES TO ADVISE OUR MANY FRIENDS AND CUSTOMERS that we now have available a highly prized and rare synthetic gem for direct sale. We refer to Star Sapphires and Star Rubies. By reading this comparative chart on your right you will see that our product exactly coincides with that found naturally. The technical name of our Stars is Synthetic Stars containing Rutile—the material from which our widely acclaimed **TITANIUM RUTILE** gems are made. In line with our standard policy we refer to our products by their regular technical names and you may thus order them since we haven't developed any descriptive trade names. These Stars (as they are called) mounted or just possessed as made are perhaps the loveliest gems anyone can own. Our product will reflect the six legs you see in this original photograph under incandescent sun, AND FLUORESCENT lighting. The latter, by the way, is the true test of a star. Each gem comes in a different weight and shape since they come forth from the laboratory as is. They are hand polished. Thus, one can be certain of having a truly individual gem. The Star Sapphires are the true deep blue of the most costly natural type and the Star Rubies have the most beautiful brilliant ruby hue so greatly desired by the connoisseur. They are available from 3 carats up. It is suggested that you order closer to the 5 carat range although the perfection of each gem is guaranteed in all sizes. When you have purchased your exquisite Star either Sapphire or Ruby from us you can then consult your jeweler for a mounting that will complement your precious possession. We handle only the one grade of Stars. This is the patented top quality containg Rutile. Our direct selling method brings these lovely creations directly to you for **$10.00** per carat plus 20% Federal Tax, postpaid. Subject, of course, to the famous Hudson "30 Day Free Trial—Unconditional Money Back Guarantee—You must be satisfied."



(Actual Photo of a Typical Group)

Technical Chart: Star Sapphire and Star Ruby

Compare:	Our Synthetic	Natural
Basic Chemical Composition	Aluminum Oxide	Aluminum Oxide
Physical Form	Single Crystal	Single Crystal
Crystal System	Hexagonal	Hexagonal
Hardness	9.0	9.0
Color of Stone	Silky Blue or Silky Red	Silky Blue or Silky Red
Coloring Agent	Metallic Oxides	Metallic Oxides
Color of Star	Milky	Milky
Cause of Star Effect	Silky Oriented Inclusions	Silky Oriented Inclusions
Type of Star	6 Rays	6 Rays
Specific Gravity	3.99	3.99
Dichroism	Strong	Strong
Melting Point, °F.	3700	3700

TITANIUM RUTILE, THE NEW WONDER GEM OF SCIENCE

Widely reported in such leading publications as TIME, Feb. 26, 1951, READER'S DIGEST, SATURDAY EVE. POST

REFRACTIVE INDEX ABOUT 10% HIGHER THAN DIAMONDS

Compare: Refractive Index of Rutile is between 2.62 and 2.90 as compared to the diamond's 2.42. Dispersion of Rutile ranges between 0.155 and 0.205 in comparison to the diamond's 0.025.

Our Titanium Rutile (made from Titanium Dioxide) continues to meet with ready and satisfied acceptance by our many customers, everywhere. We quote from a typical testimonial letter the original of which is in our files for all to see and verify. *"I have just received the two 1 carat titanium rutile gems which were ordered by me on March 13, 1951 and wish to thank you for your prompt service in this matter. These stones certainly are of fine quality and well cut. I am highly pleased with them. Enclosed is my check No. 594 in the amount of $36 for which I would like to have you send me the following titanium rutile gems."*

(1 carat)

(5 carat)

(10 carat)

We are showing RUTILE as cut by us in 3 sizes, actual size, so that you can use this ad as a guide in selecting the exact size you want. The smallest stones shown are 1 carat, the in-between stones are 5 carats and the largest showing is 10 carats. Due to printing tolerances, these actual sizes shown are necessarily just a shade off, but you still get a good idea. The cut shown is the exact type used by us since these photos were taken from the actual stones and are not drawings. *Our Brilliant (round cuts) have 58 facets, hand cut and polished. 58 facets are standard. In company with other cutters we have experimented with a higher number of facets. However, too many facets have a tendency to break the light up in a glittering, shallow way just as too few result in lack of life and fire.* We recommend Emerald and Marquise cuts be 2 carats and up for greatest beauty.

By the way, numerous inquiries reach us weekly asking if our Titanium Rutile is the same material widely advertised under various trade names. The answer is yes. Our lapidaries carefully select the best Rutile "boules" (as they are called) and carefully and painstakingly cut and polish them by hand.

You may now order Titanium Rutile (the new wonder gem—more brilliant than diamonds) in any size you wish from 1 carat up. Our increasing production now regularly ranges in such sizes as 1, 1½, 2, 2½, etc., and in the ¼ and ¾ fractions, all the way to 10 carats. **$10.00** per carat plus 20% Federal Tax, postpaid.

Hudson Gem Co. sells Rutile only in the cut stones. We do not sell mountings nor do we furnish elaborate catalogs nor sell on time payment plans which raise the cost. In this way we are able to virtually wholesale this valuable merchandise DIRECTLY to the final consumer without any middlemen. After you obtain your valuable selected stone from us your local, trusted jeweler in whom you have confidence will set it for you in the mounting of your choice which will then FIT YOU PERFECTLY and satisfy you in every way. The main thing is THE GEM and this we sell you at the VERY LOWEST COST ANYWHERE. Please remember that you are covered by our UNCONDITIONAL MONEY BACK GUARANTEE. You are the sole judge. We want you to be a satisfied customer because our business grows and depends upon giving satisfaction to everyone. The DOLLARS YOU SAVE with our Titanium Rutile will go far toward building a happy, permanent home—particularly when prices are so high for everything. A handsome engagement ring made of our NEW WONDER GEM will inspire the love and devotion of any girl. When you buy Titanium Rutile for your ring you are doing the wise and practical thing. The cost of Diamonds being determined largely by scarcity and control it seems much wiser, to make your loved one happy and satisfied with a BEAUTIFUL RUTILE and BANK THE DIFFERENCE.

HUDSON GEM CO., DEPT. PS-4, 15 E. 47 ST., N.Y.C. 17, N.Y.

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THE MAGAZINE OF NEW AND USEFUL IDEAS

Founded 1872, Vol. 158: No. 6

POPULAR SCIENCE
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Mechanics and Handicraft

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OVER the years, Studebaker **has** won a reputation for the finest **quality** in cars and trucks. Generations of highly skilled craftsmen — many of them father-and-son teams — **have** built into Studebaker engines a **perfect** combination of power, **economy,** smooth operation, dependable life.

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Now, more than ever, it's **important** to guard your car's engine with **a** famous Fram Oil and Motor Cleaner. Removes abrasives and corrosives **that** contribute to friction, wear, breakdowns, repairs. Fram keeps your **engine** clean. Adds miles. Cuts repairs. Saves you money.

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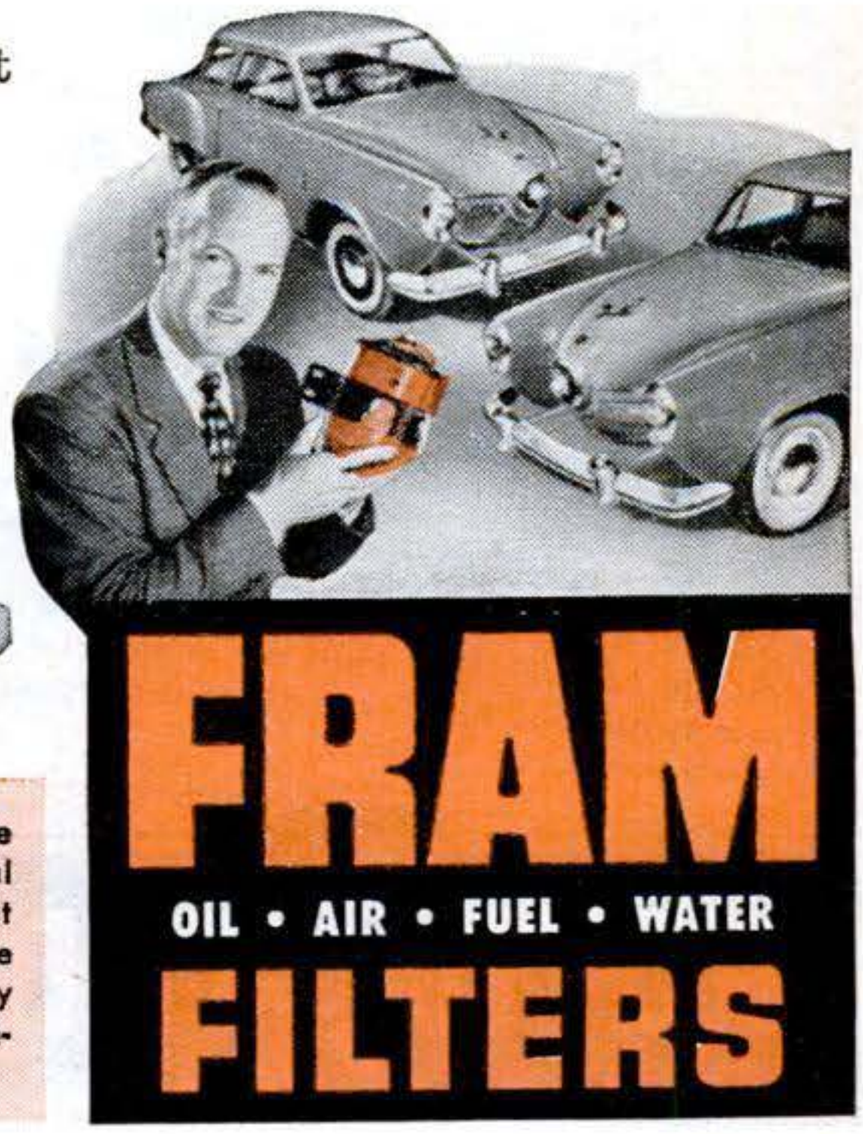

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How Can a Vacuum Cleaner Cut Wood?

WHEN it becomes a high-speed, fancy-cutting router. Two big articles in next month's POPULAR SCIENCE will tell you what you can do with this versatile tool and how you can make your own rugged machine out of a discarded vacuum-cleaner motor.

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Up to the top . . . together

If you've ever asked yourself "What can I do to get ahead?" you'll find the story of Ernest and Janet Jarvis interesting and inspiring

They married young. Neither had finished grammar school. Both worked—and studied.

Ernest was enrolled with the International Correspondence Schools. Janet helped him with his lessons. Together they mastered Chemistry, Metallurgy and other I. C. S. subjects.

Slowly, surely, their training bore fruit. Ernest was made plant manager of a marine pump and valve factory. Mrs. Jarvis worked as a chemist in the laboratory.

Then, with $3500 savings, they started their own business, the Niagara Falls Smelting & Refining Co. Inside twenty years, it became the nation's largest producer of nonferrous alloys.

In 1944 they sold the company and retired as millionaires. But they couldn't stop. Before the year was out, the Jarvises were working again.

Today, Ernest Jarvis is President of the Continental Copper & Steel Industries, Inc. And Janet Jarvis, a chemist and metallurgist famed throughout the industry, is Vice-President.

Says Mr. Jarvis: "I have always felt that the training we obtained by studying I. C. S. courses at night was responsible for our success in life."

It takes courage and co-operation, hard work and sound training to do what the Jarvises did. The first three are up to you. Sound training starts with the coupon below. Mail it *today*.

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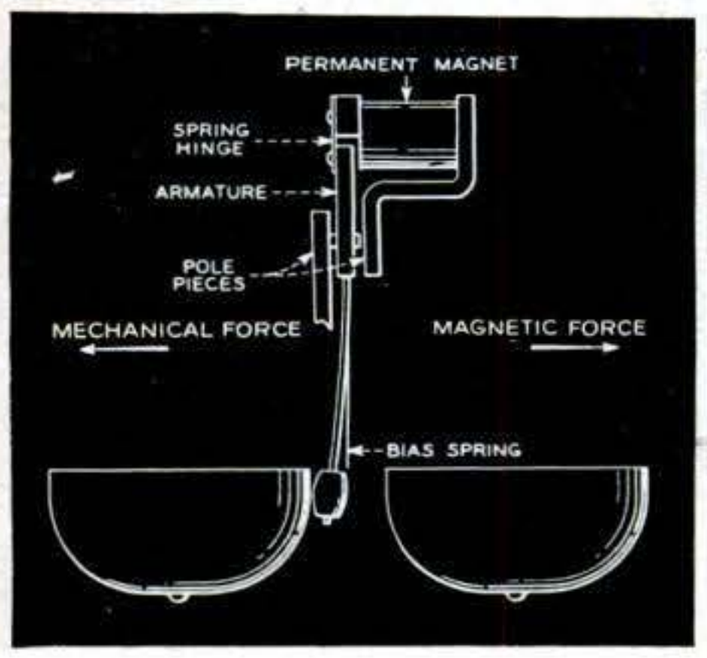

The Bell System's new automatic method of adjusting telephone ringers uses a beam of light passing between the gongs to a photoelectric cell. When test currents are applied to the ringer the machine decides whether to change the spring tension or the magnetic pull. After each change it tests again until the ringer is in perfect adjustment—and the whole procedure takes only 30 seconds.

To YOU, it's your familiar telephone bell. To telephone engineers, it's a "ringer." And it has two jobs to do.

It must ring, of course, when someone calls you. And it must overlook the numerous electrical impulses which do not concern it, such as those sent out by your dial.

Ability to respond to some impulses, to ignore others, requires exact adjustment between the pull of a magnet and the tension of a spring. If they are out of balance your telephone might tinkle when it oughtn't, or keep silent when it should ring.

In the past, adjustment was made by hand, little by little until the proper setting was reached. It took time. But now Bell Laboratories engineers have developed a machine which adjusts new ringers perfectly, before they leave the Western Electric Company plants where they are made. And the operation takes just 30 seconds.

This is another example of how the Laboratories work constantly to improve every phase of telephony — keeping the costs low while the quality of service grows higher and higher.

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WORKING CONTINUALLY TO KEEP YOUR TELEPHONE SERVICE ONE OF TODAY'S GREATEST VALUES

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2. GOOD PAY JOB

Your next step is a good job installing and servicing Radio-Television sets or becoming boss of your own Radio-Television sales and service shop or getting a good job in a Broadcasting Station. Today there are over 90,000,000 home and auto Radios. 3100 Broadcasting Stations are on the air. Aviation and Police Radio, Micro-Wave Relay, Two-Way Radio are all expanding, making more and better opportunities for servicing and communication technicians and FCC licensed operators.

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And think of the opportunities in Television! In 1950 over 5,000,000 Television sets were sold. By 1954 authorities estimate 25,000,000 Television sets will be in use. Over 100 Television Stations are now operating, with experts predicting 1,000. Now is the time to get in line for success and a bright future in America's fast-growing industry. Be a Radio-Television Technician. Mail coupon for Lesson and Book—FREE.

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Mail Coupon For 2 Books FREE

Act Now! Send for my FREE DOUBLE OFFER. Coupon entitles you to actual lesson on Servicing; shows how you learn Radio-Television at home. You'll also receive my 64-page book, "How to Be a Success in Radio-Television." You'll read what my graduates are doing, earning; see photos of equipment you practice with at home. Send coupon in envelope or paste on postal. J. E. SMITH, Pres., Dept. **1FB,** National Radio Institute, Washington 9, D. C. . . . Our 38th year.

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Mr. J. E. SMITH, President, Dept. 1FB,
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Letters

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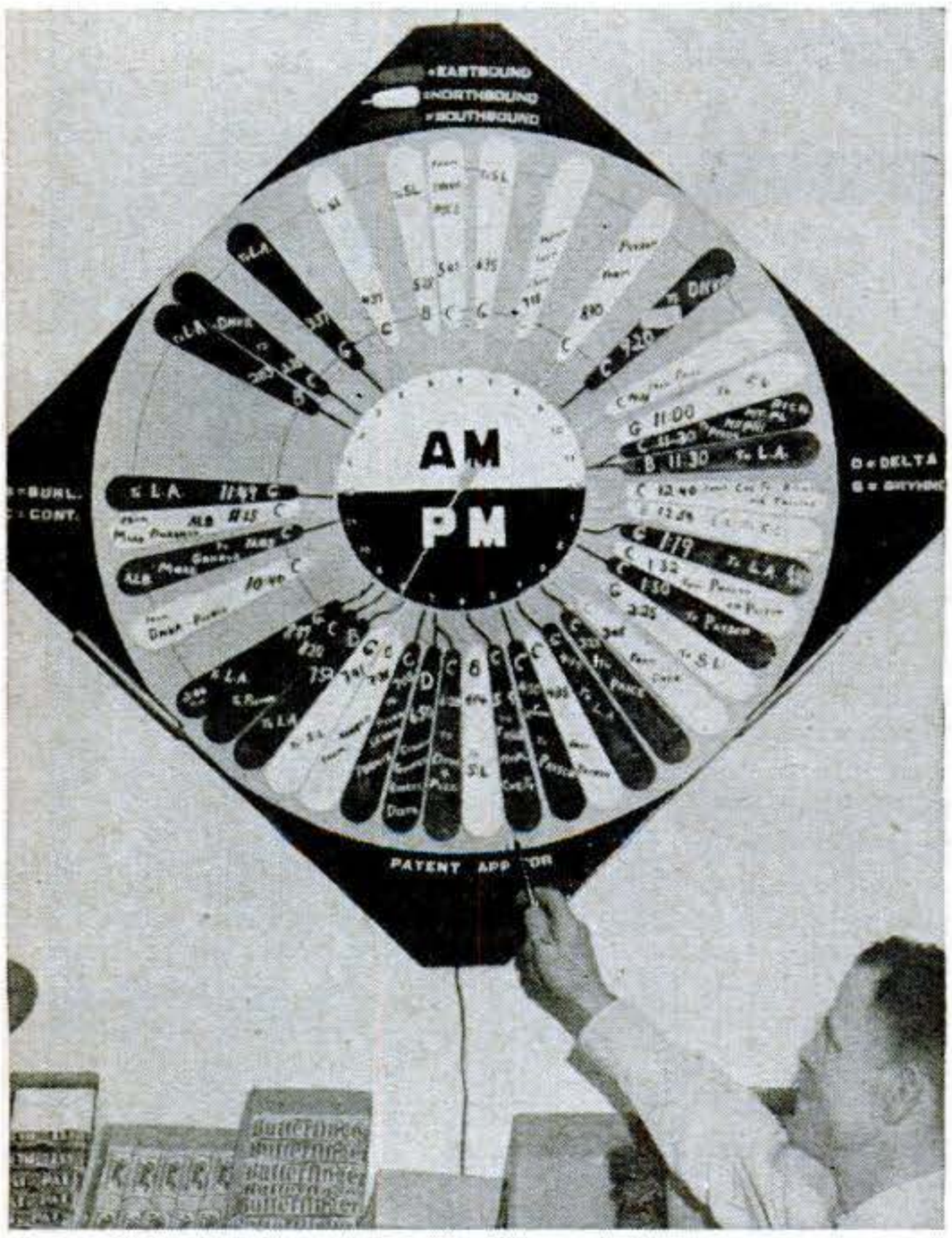
Sir:

Enclosed is a picture of a new invention that should revolutionize the manner of presenting train and bus schedules. The picture is of the present schedule of all the buses that go through Spanish Fork, Utah, each day.



The customer can see for himself what his departure time will be, where he will change to another bus or train, and the time between any given points or from his initial starting point.

RALPH H. BRAMWELL

Spanish Fork, Utah

Pushmi-Pullyu

Sir:

A friend and I were talking about boats and airplanes and their means of propulsion. A discussion arose on whether a plane or a boat was pushed or pulled through its medium.

I contend that, regardless of the position of the motivating power in relation to the body to be propelled, the body is always being pushed and not pulled.

As a constant reader of PS I would appreciate any information you can supply on this subject.

ELMER S. HODSON

Suffern, N.Y.

You started a discussion here, too. As a screw or propeller turns, the pressure is more behind the blade than it is ahead of it. The air or water pushes *the blade, but the blade* pulls *itself and whatever it powers. What's your choice?*

Saved Money

Sir:

May I compliment you on "Everybody's Furniture Anyone Can Make," which appeared in PS for December on page 98. You advised it would cost ninety-nine dollars for

materials, but it cost me ninety-five, so I came out four dollars to the good.

CHARLES BURRUANO

Buffalo, N.Y.

It Can Happen Here

Sir:

I want to congratulate R. G. Le Tourneau, Inc., of Peoria, Ill., on the new tractor pictured on p. 152 in your Feb. 1951 issue. I feel almost as if my brainchild of 1944 has been brought to life. I conjured up the idea then when you were asking us readers what we would like in our post-war cars. Remember? Just look back in your July issue 1944, page 128.

P. CARL STORR

Pocahontas, Iowa

Run Ragged

Sir:

You illustrate how an "extra wheel measures road distance" on page 138 of the December PS. I recall that about fifty years ago, when the U.S. Government made the Geological Survey of Ohio, five young men came to our village. They went to the livery and each hired a one-horse rig. The first

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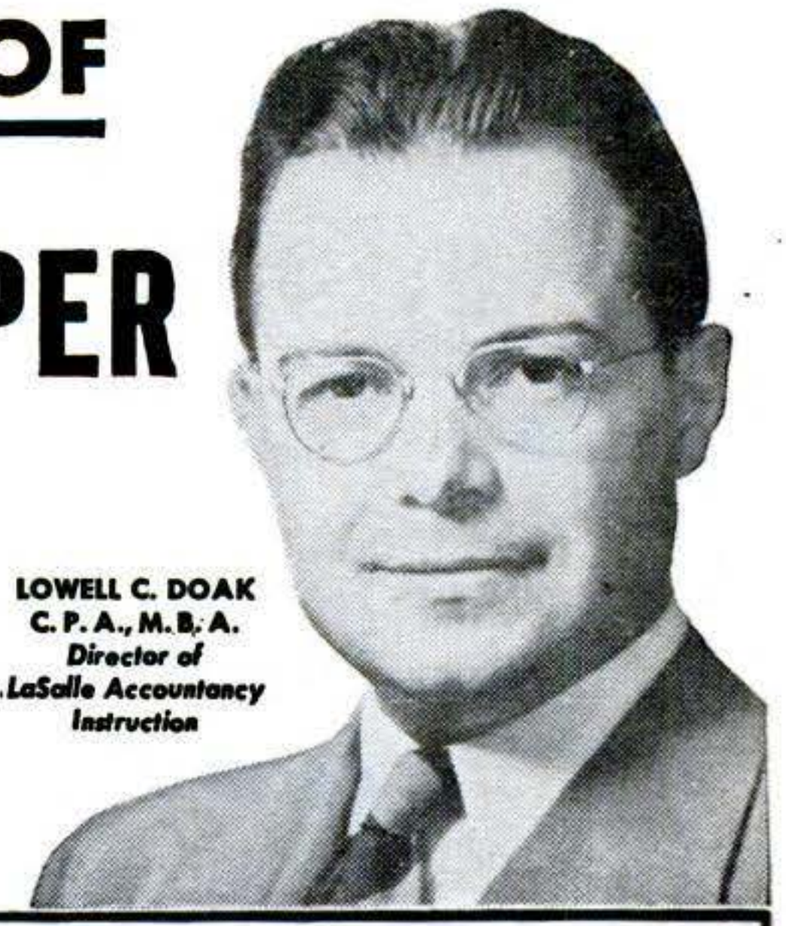

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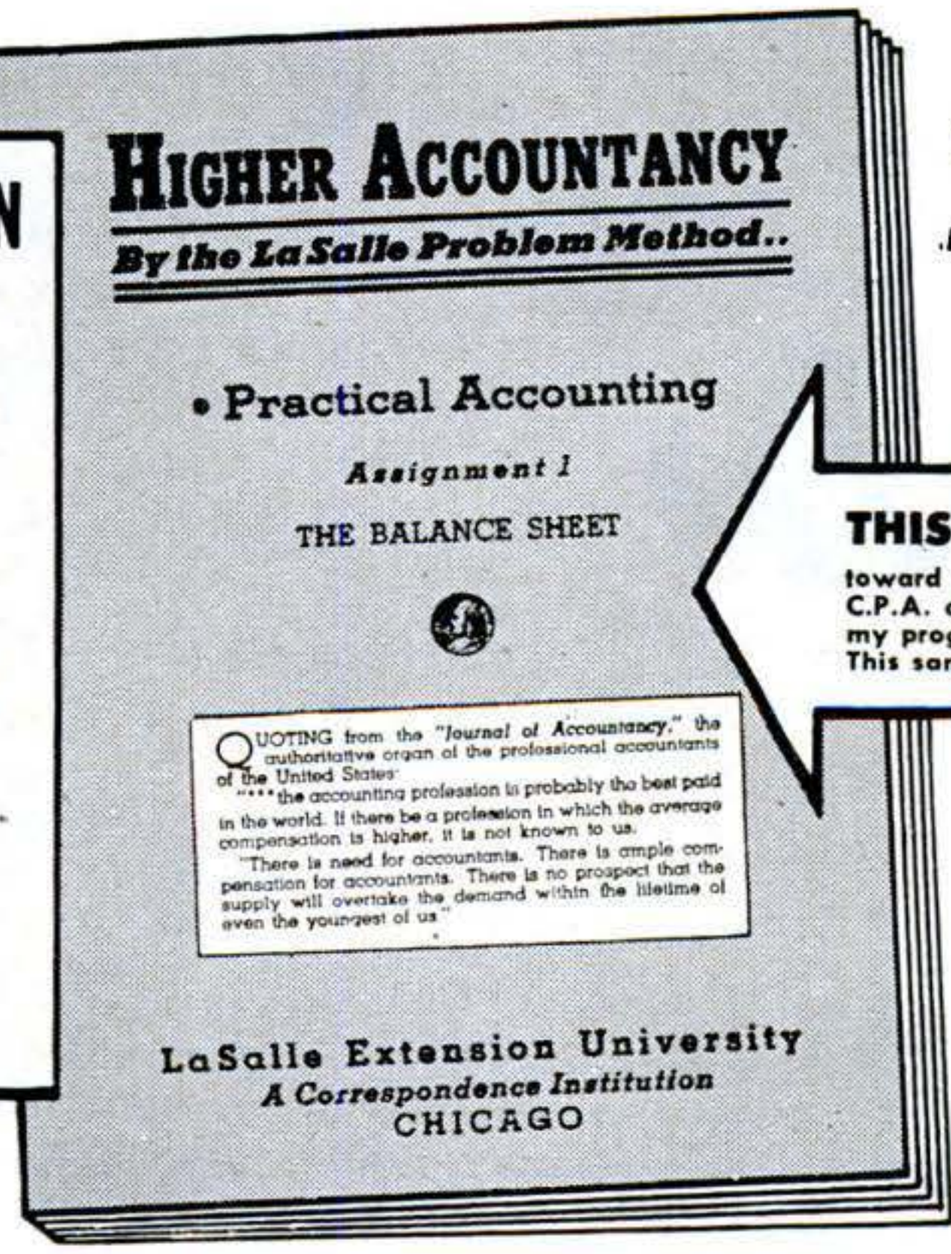

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thing they did before going out each morning was to measure the diameter of the front wheels. Then they tied a white rag to one

of the spokes and kept count of the revolutions. They kept track of distance on cross-section paper, sketching direction by compass, and making dots to indicate buildings.

A. H. LEIMBACH

Vermillion, Ohio

Stick Sleeks

Sir:

How can I remove a deep scratch from my windshield?

JACK DUBINSKI

Nanticoke, Pa.

You can't. Any scratch that can be felt, even minutely, when you run your fingernail across it is considered too deep to remove. Even the manufacturers scrap such scratched glass. You can remove light scratches, called "sleeks," and the depression will not be noticeable. A pastelike solution of water and polishing rouge should be applied liberally to the glass and the area rubbed vigorously with a piece of felt (also saturated with the rouge solution) approximately ½ an inch thick and glued to a wood back-up block. The block should be 1½ to 2 inches wide and 8 to 10 inches long with some form of handle that will enable the operator to apply a good deal of pressure. The surface of the block to which the felt is glued should be curved so that only one or two inches of the length will contact the glass at one time. When the rouge solution dries up, it should be wiped off, the glass inspected, and the cycle repeated as many times as necessary. Take care not to localize the rubbing. This would produce a noticeable depression. The method is laborious and a careless worker may add new sleeks while removing the old ones.

Old Reliable

Sir:

I have had a neon blinker light in operation for exactly three years on the same two

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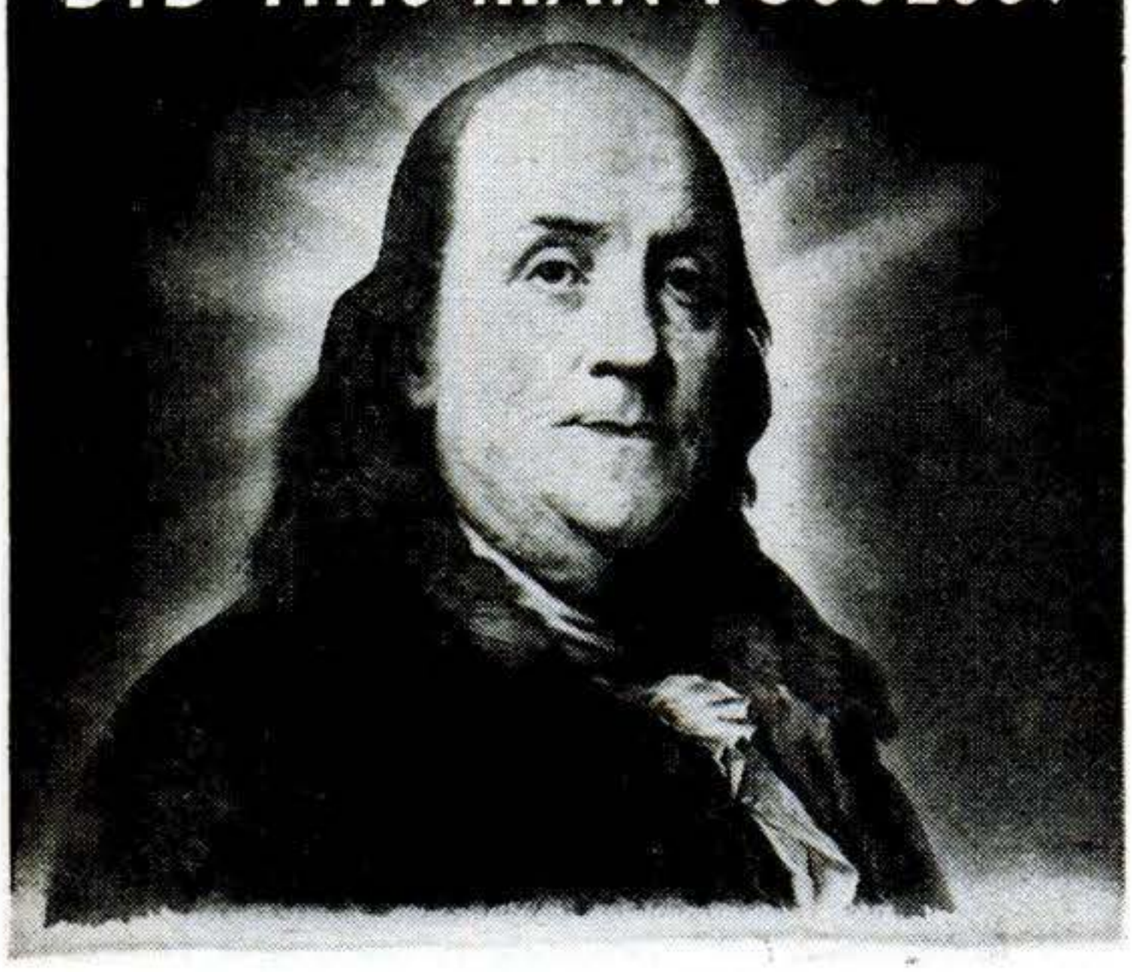

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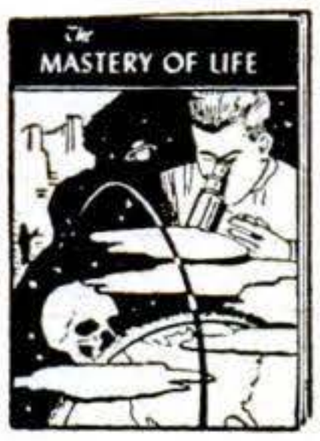

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Scribe Z. A. K.
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67½-volt cells (Eveready Minimax). It just quit working and I have renewed the batteries. Thought you may be interested. This device was described in PS February, 1948, p. 194.

E. A. GAST

Cincinnati, Ohio

Block that Wheel

Sir:

A bumper jack is not worth anything for lifting a heavy car, and the modern cars are so low that you can't get a good jack

under them. In my cars, I carry a block of wood 6 inches wide by 4 inches thick by 2 feet long, beveled at each end. I just drive the flat up on this piece of timber and place my jack under the car.

Using a bumper jack as an accessory for removing tight nuts (PS, March '51, p. 195) reads well. I'll surely try it. I've never found any other use for a bumper jack. If it works, it will be a boon to the victims of weak backs.

J. J. HORTON, M.D.

Buda, Texas

Dry-Wood Termites

Sir:

In your splendid article "Termites Can Be Defeated," PS, March, '51, you say that "the subterranean termite is the one that damages homes." While it is true the subterranean termite is probably most important for the country as a whole, dry-wood termites (Kalotermes) do a great deal of damage in California and all along the southern borders of the United States. They can also be found along the coastal area of Georgia and the Carolinas. Damage runs to several million dollars a year.

Kalotermes do not require contact with the soil for their existence as do "Subs." Fumigation seems to be the most effective way to control the dry-wood species.

JAMES A. NELSON
Editor, Pest Control

Cleveland, Ohio

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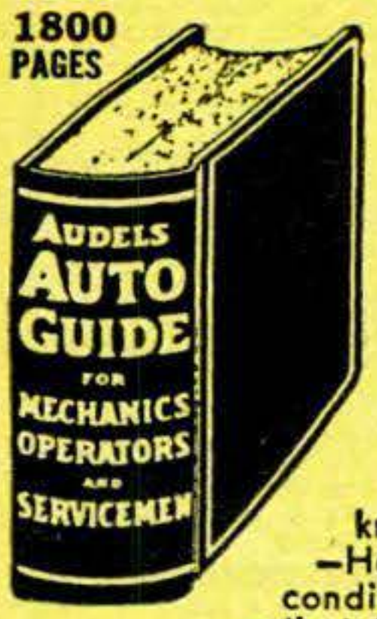

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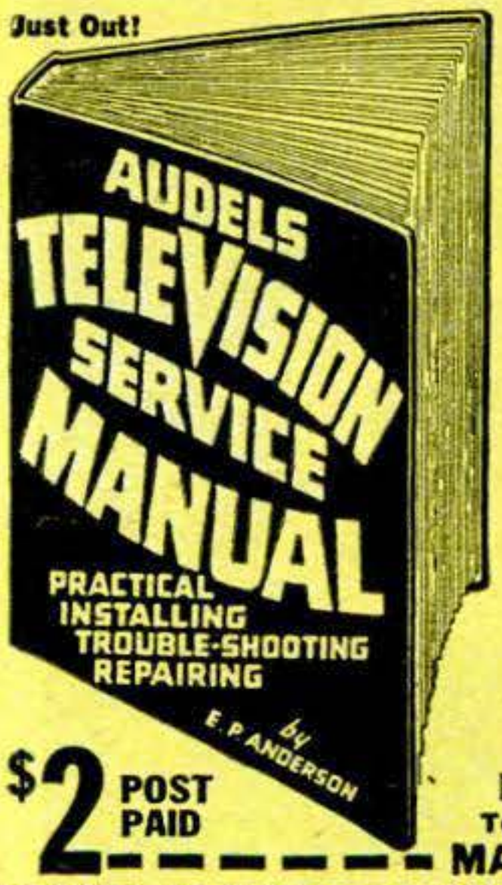

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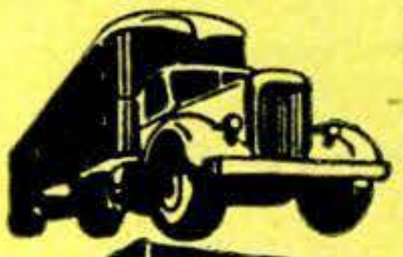

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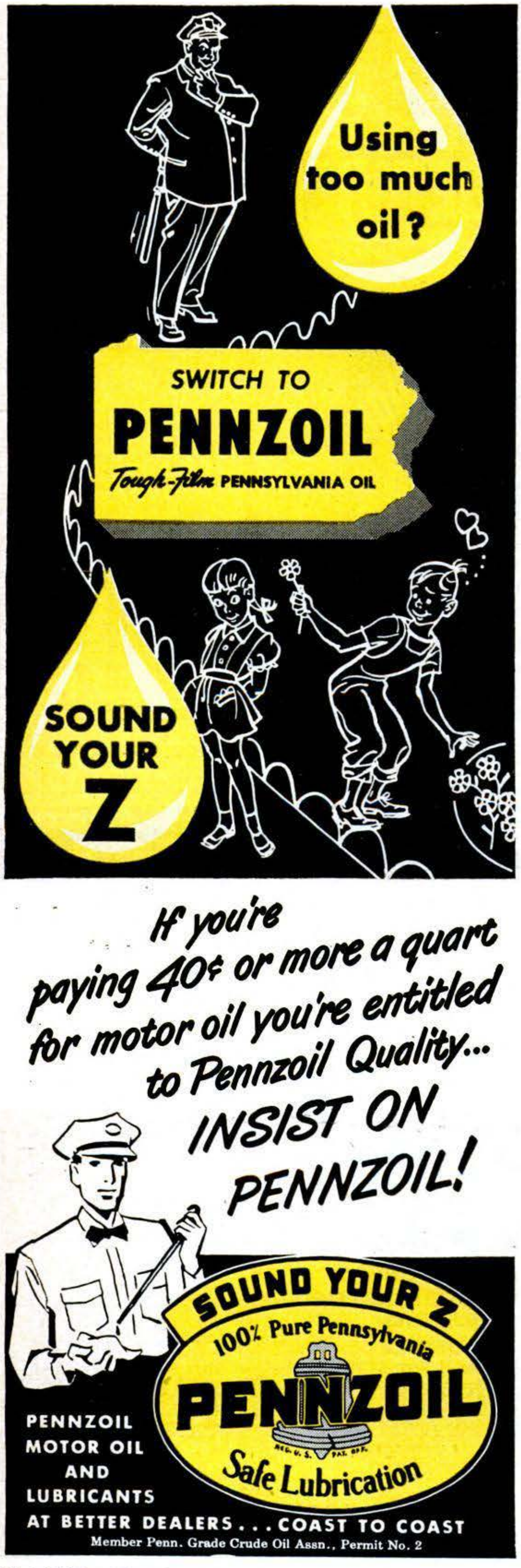

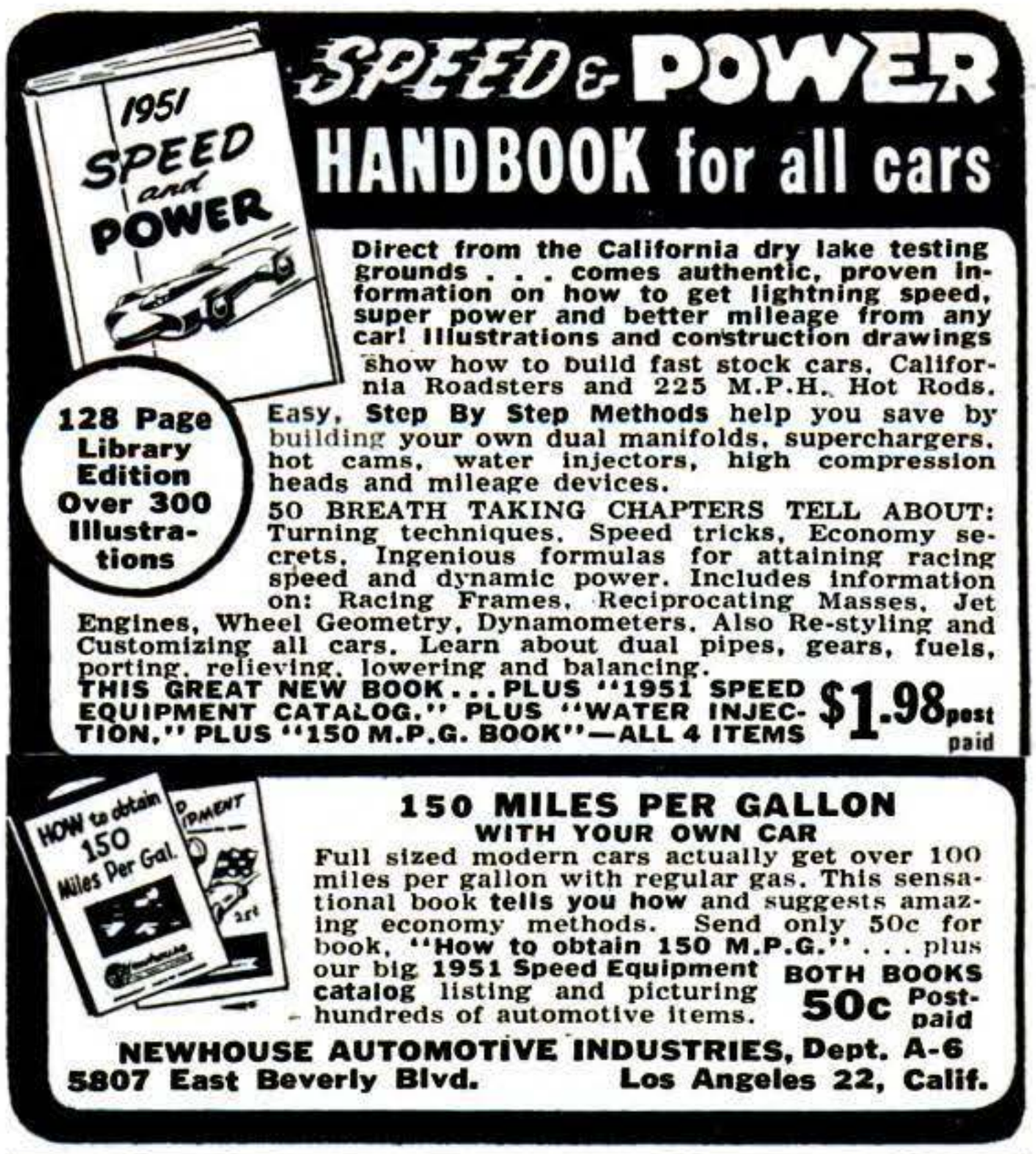

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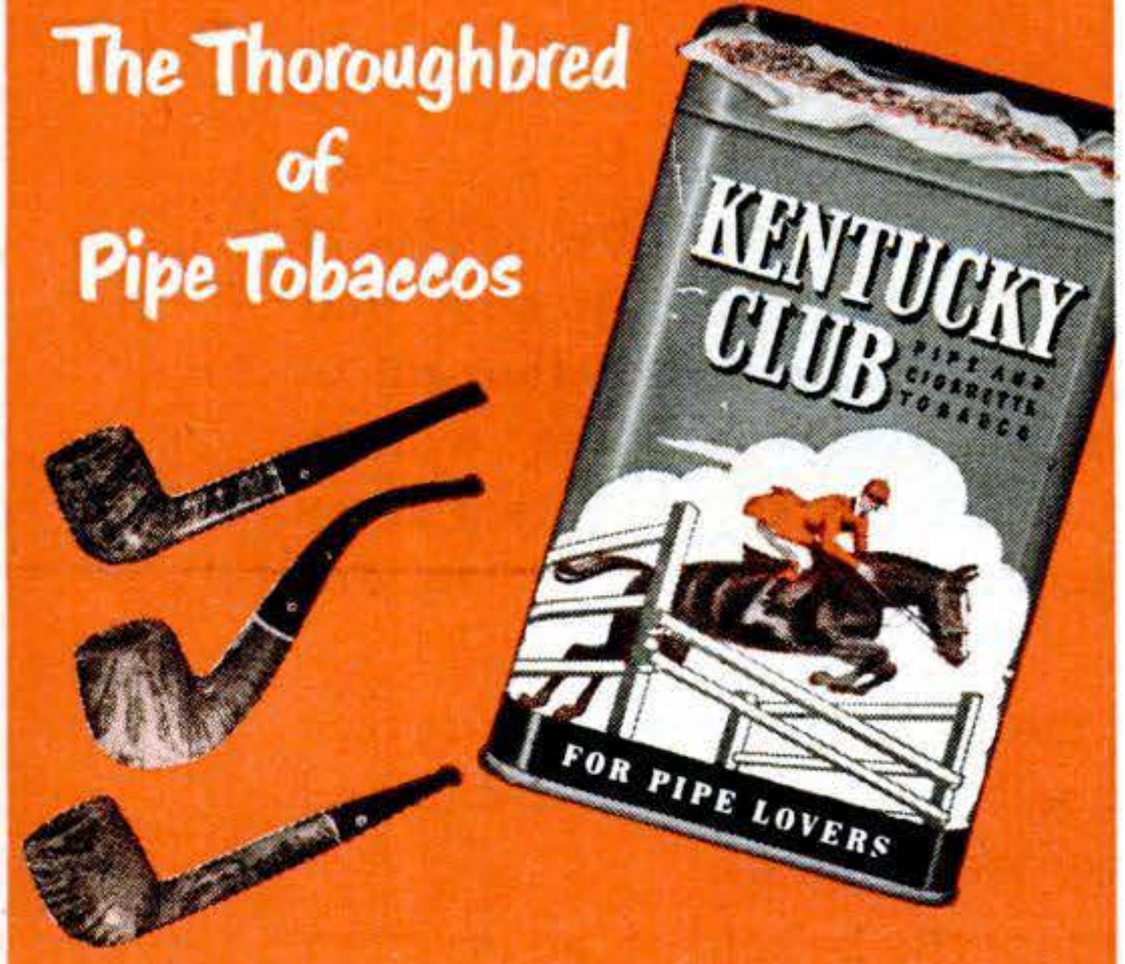

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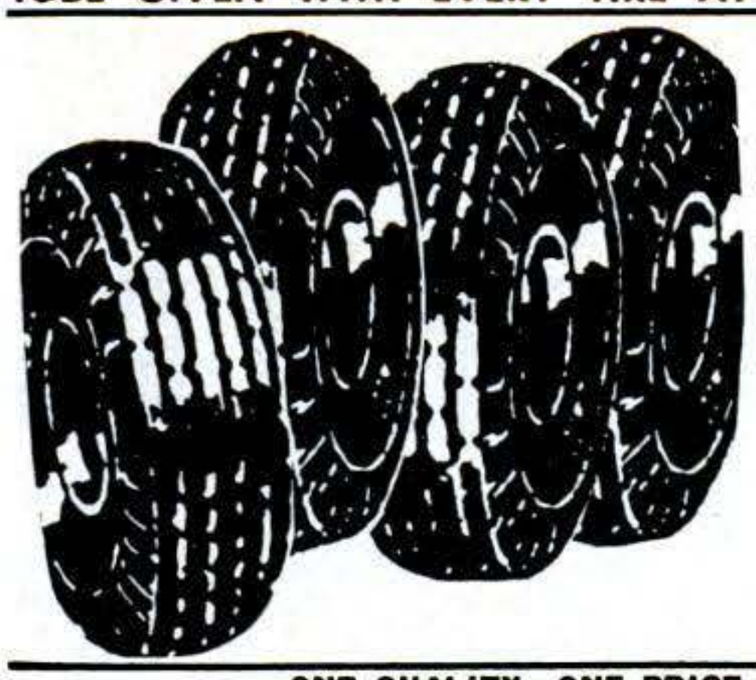

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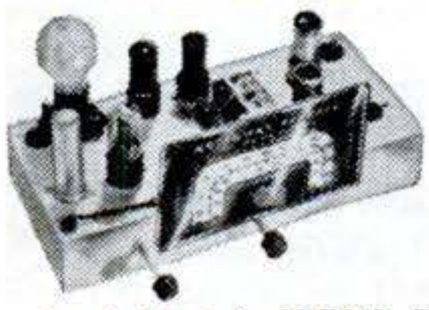

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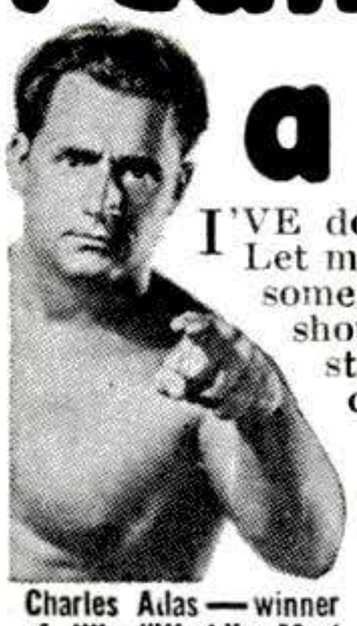

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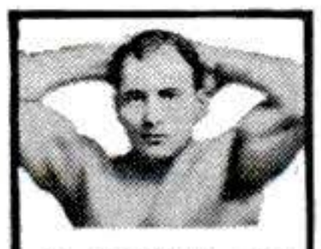

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550-17	5.94	760-15	6.54	32x6(10)	13.92	1100-22	18.54
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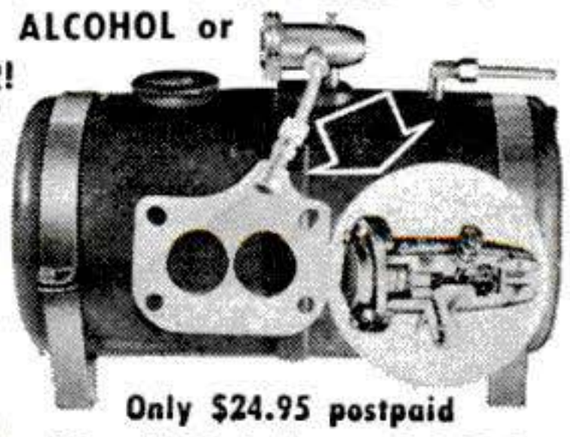

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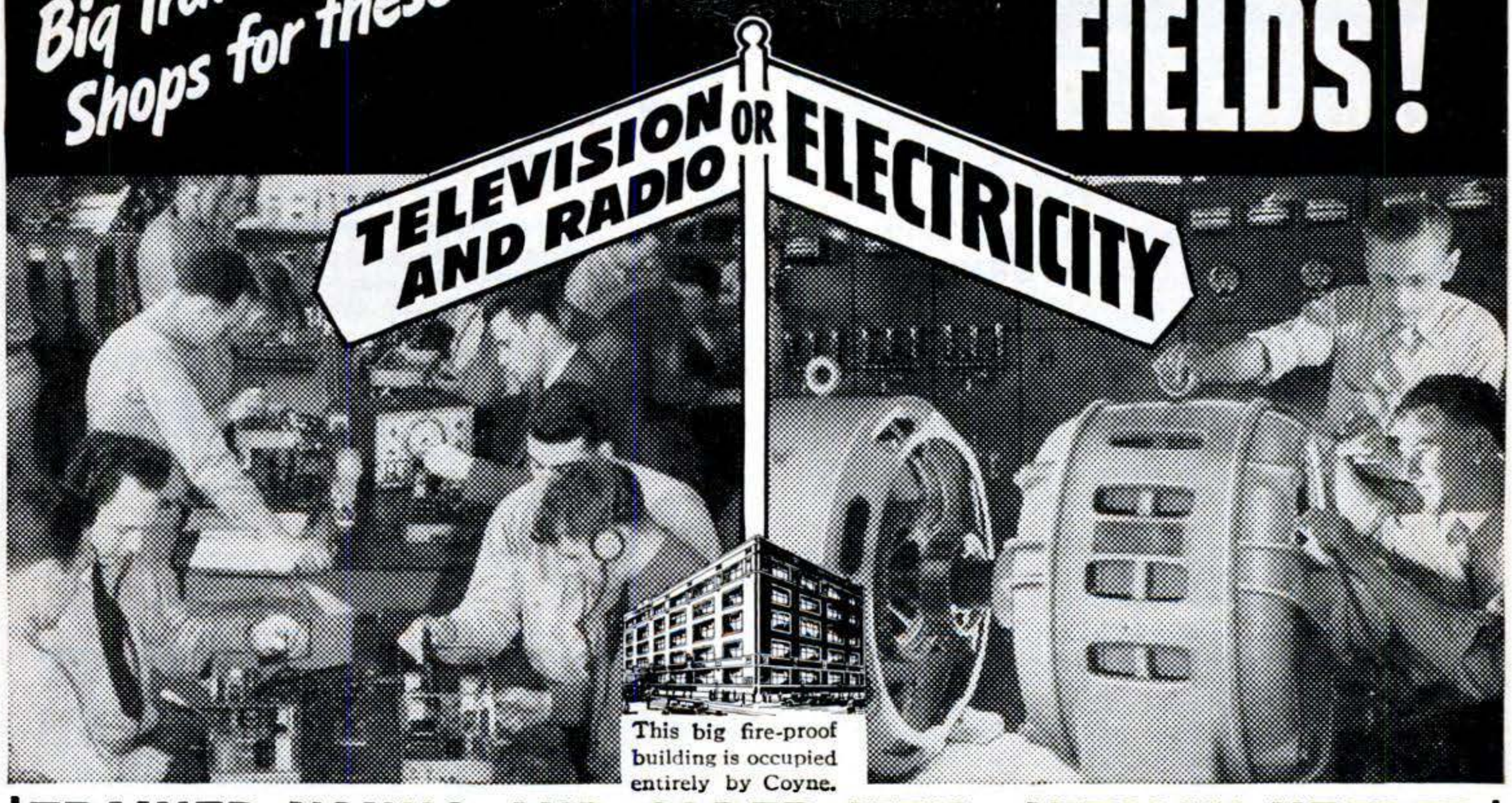

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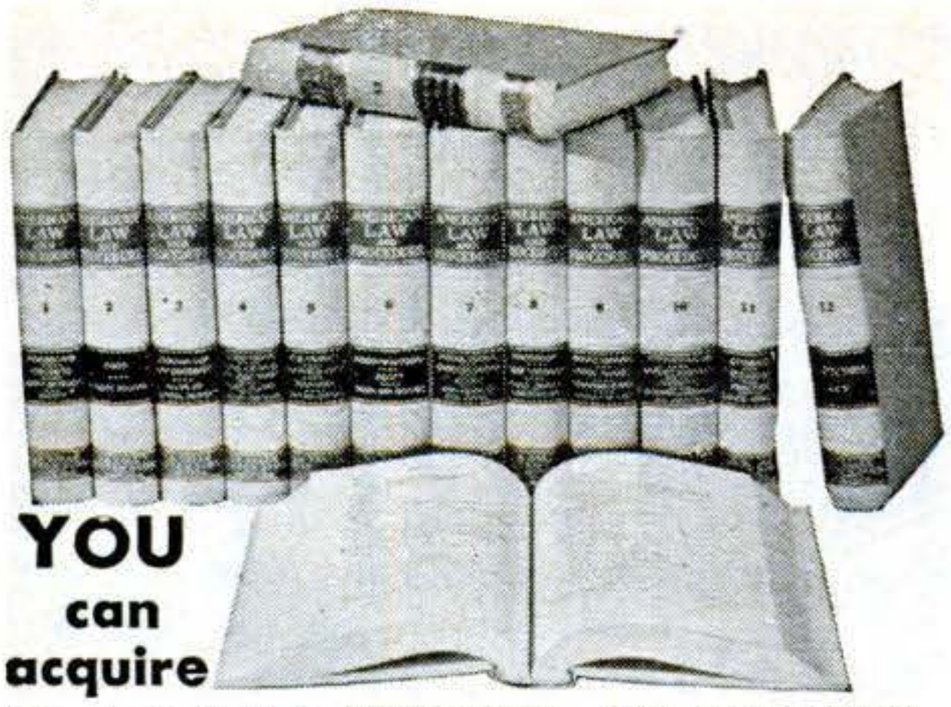

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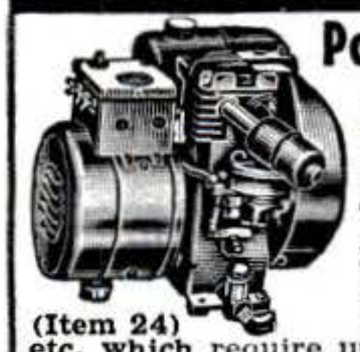

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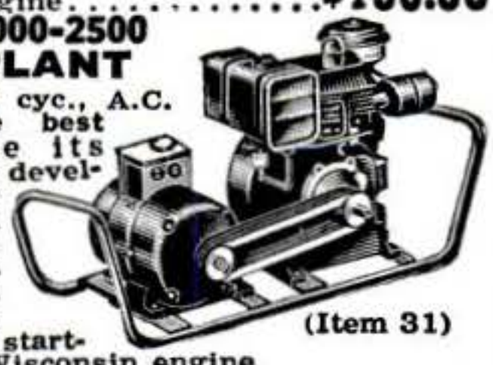
PUSH BUTTON START

(Item 24) 500-700 watts 110-120 v. — 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1¾ hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. Be prepared if war or storm knocks out power lines.
Reg. $275.00 value..... **$143.50**

700-800 Watt Plant (Item 44) same as Item 24, but larger generator..... **$169.95**

1000-1200 Watt Plant (Item 45) same as Item 24, but larger generator & engine..... **$199.50**

GIANT 2000-2500 WATT PLANT



(Item 31)

110-120 V. 60 cyc., A.C. Absolutely the best made because its heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by 5 h. p. easy starting Briggs or Wisconsin engine —complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. $585.00. Special at.... **$299.50**

GENERATOR ONLY and control box. Drive it with your engine or tractor **$169.50**

¼" DRILL

(Item 34) Hi-power, long-life, smooth running. Alloy steel gears; built-in blower. Cutler-Hammer switch. Jacobs handtite chuck. 110-120 v. AC-DC 1000-1600 rpm. Cap. ¼" in steel. 1 year guar. Wt. 4 lbs. Terrific value at **$12.95.**

38 Pc. DRILL KIT

(Item 35) Includes above illus. guar. drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer, burrs, Complete in heavy steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth $38.50. Our Spec. only... **$19.85**

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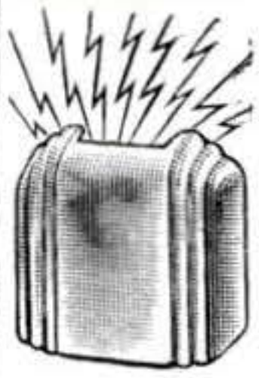

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Special..... **$4.95**

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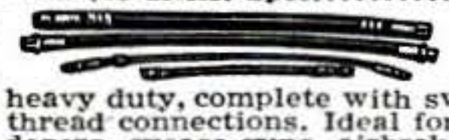
½" DRILL

Removable handle

(Item 33) DeLuxe —powerful, smooth running, precision built. Cutler-Hammer switch, Jacobs keychuck. 110-120 v. AC-DC 300-450 rpm. Alum. alloy case. Built-in blower assures cool operation. Cap. ½" in steel. Written guar. Wt. 11 lbs. Compares with $65 drills. Spec..... **$34.50**



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HEAVY DUTY ARC WELDER

(Item 38) Use as portable or shop welder. 250 amps, D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to ½" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 10 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs.
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Worth $20.00. Our price..... **$8.95**

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Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**
100 foot length (one piece)..... **$4.85**

TRENCH-LAY WIRE (Item 51) **Anaconda #10** —2 cond., for buried service to barns, outdoor lights, etc. Absolutely impervious to soil and moisture. Wt. 25 lbs. per 100 ft. Special surplus price. 100 ft. coils, **19c** per ft.; 250 ft., **18c** per ft; 500 ft., **17c** per ft.

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Our Special..... **$39.95**

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Drastically reduced..... **$39.95**

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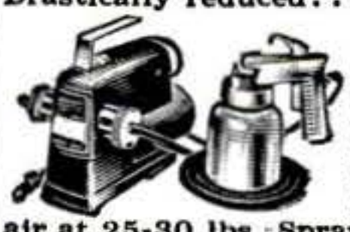

(Item 37) Twin cyl. piston type compressor direct-connected to powerful 110-120 v. AC-DC motor. Built-in air tank eliminates pulsation and provides steady flow of air at 25-30 lbs. Sprays lacquers, enamels, insecticides, etc. Does beautiful work on autos, furniture, farm equip. 1 qt. spray gun, relief valve and 10 ft. air hose incl. Full instructions and 1 year guar. Wt. 11 lbs.
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(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. **Operates at any angle in a full 360° arc.** Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (¼" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at $39.95—while they last.... **$9.95**

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Sensational value..... **$39.50**

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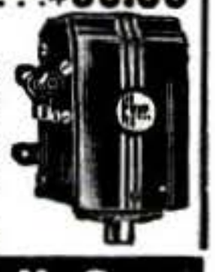

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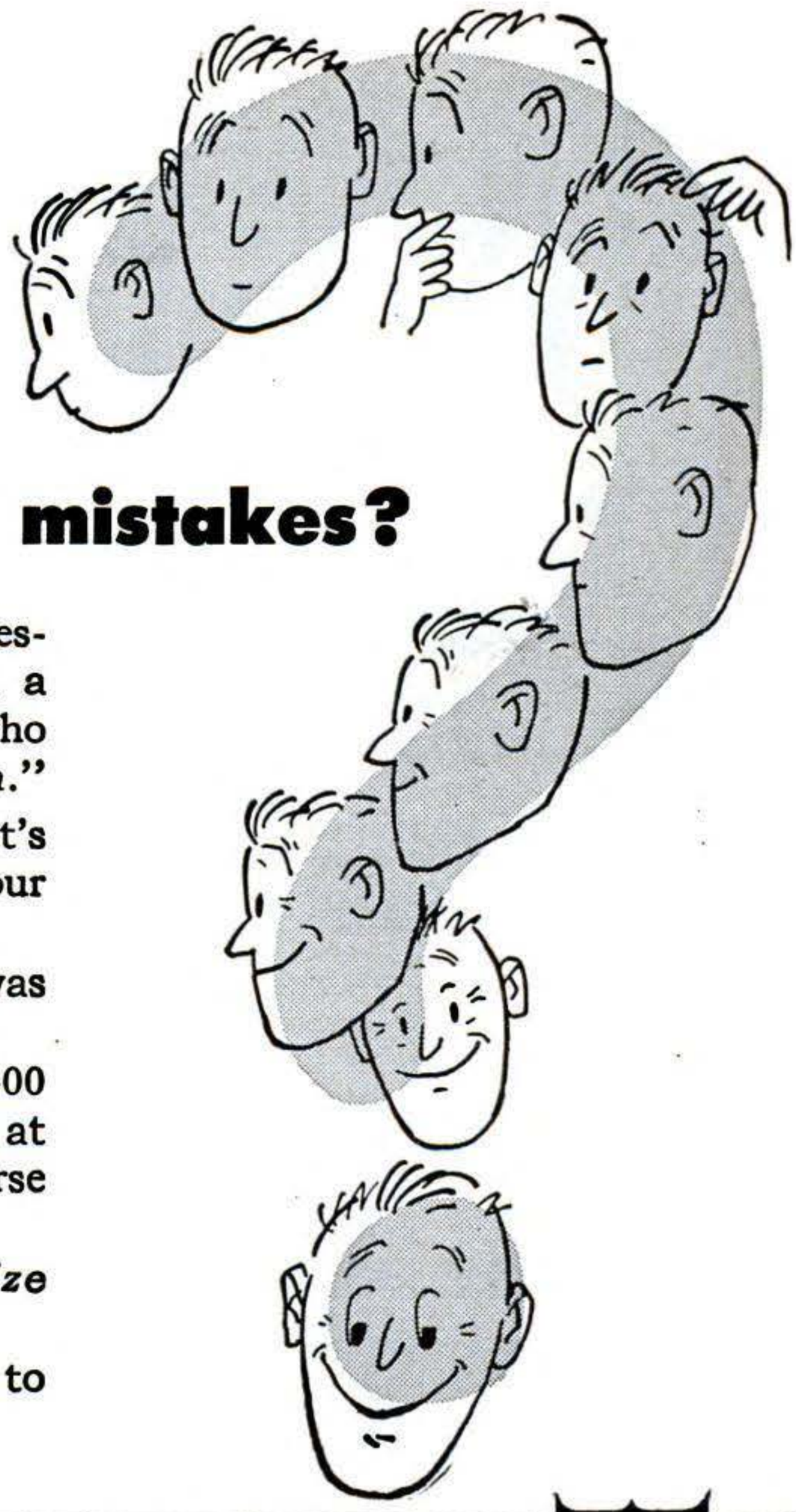

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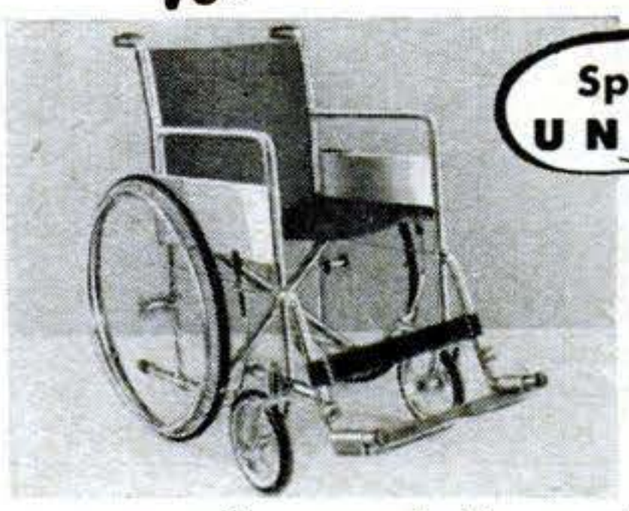

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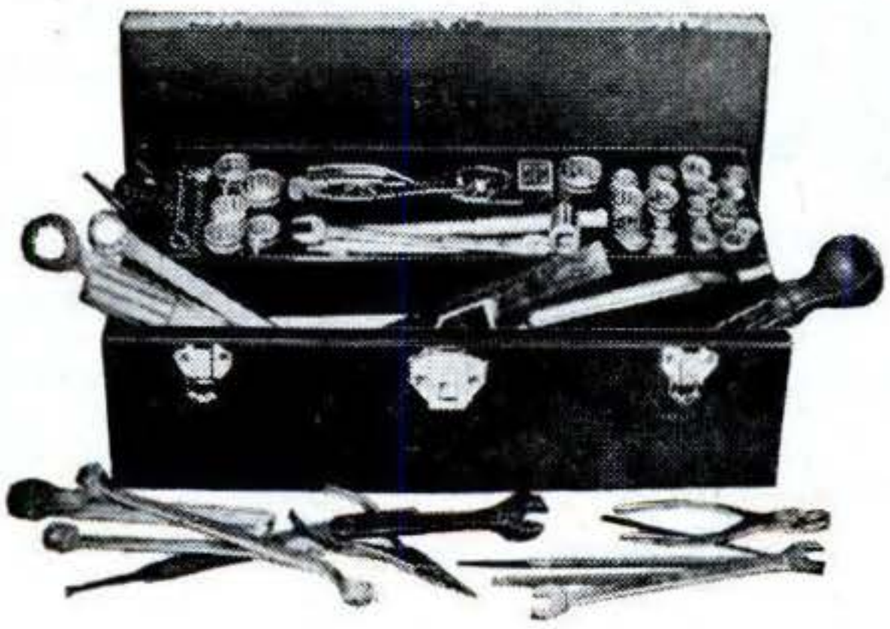

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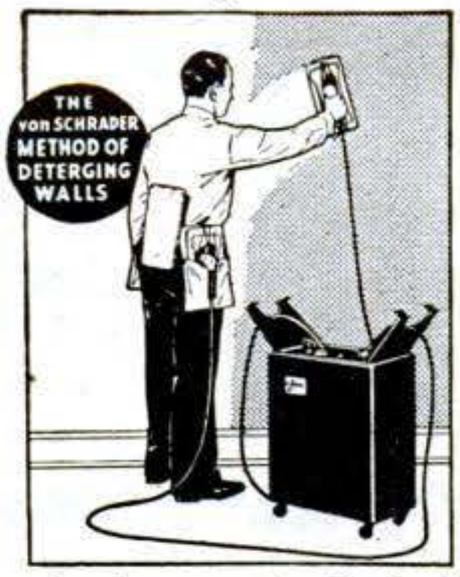

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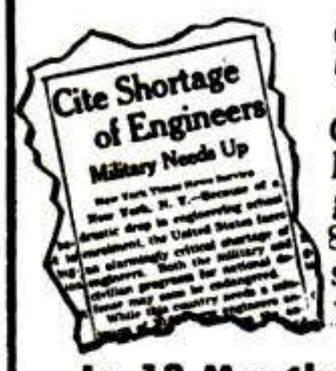

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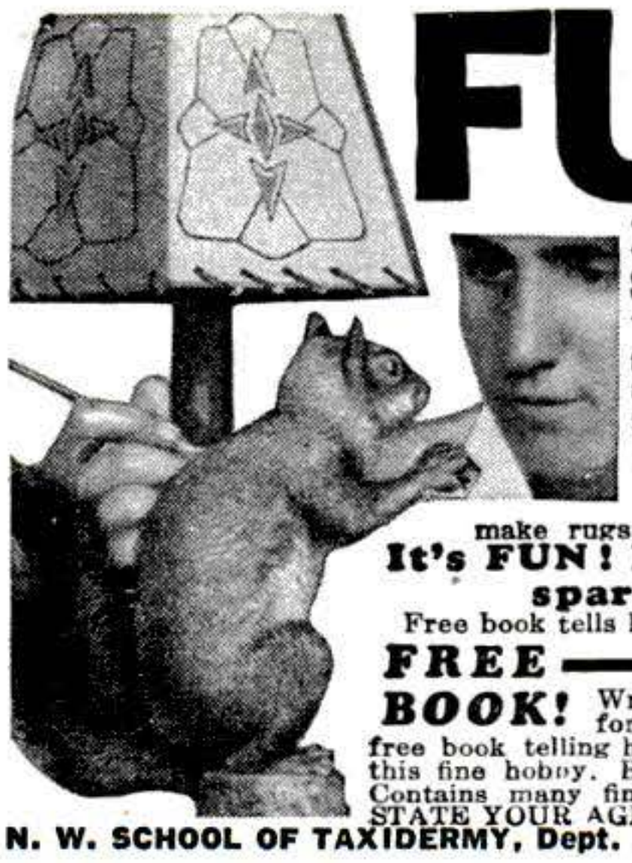

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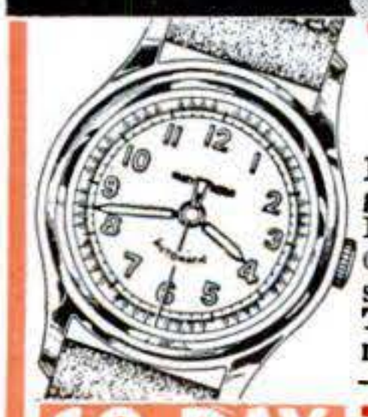

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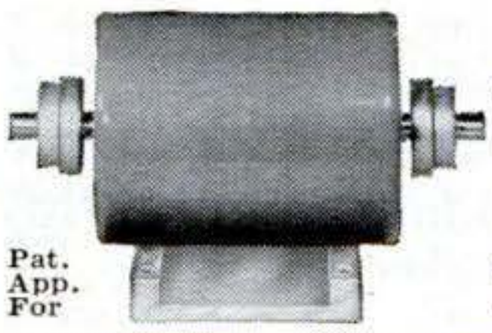

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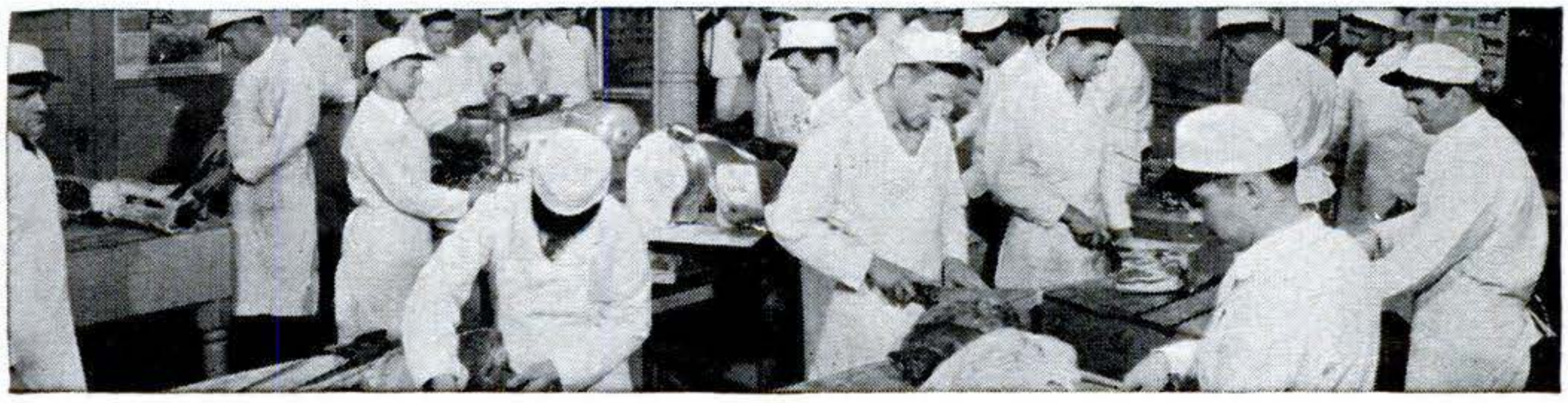

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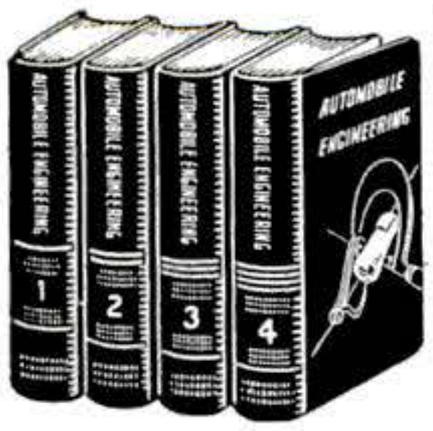

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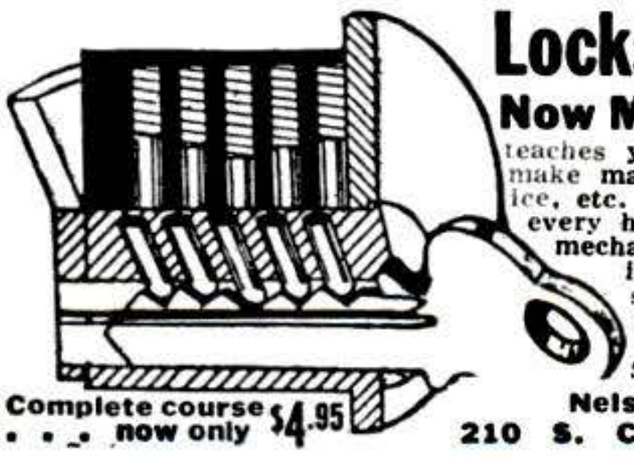

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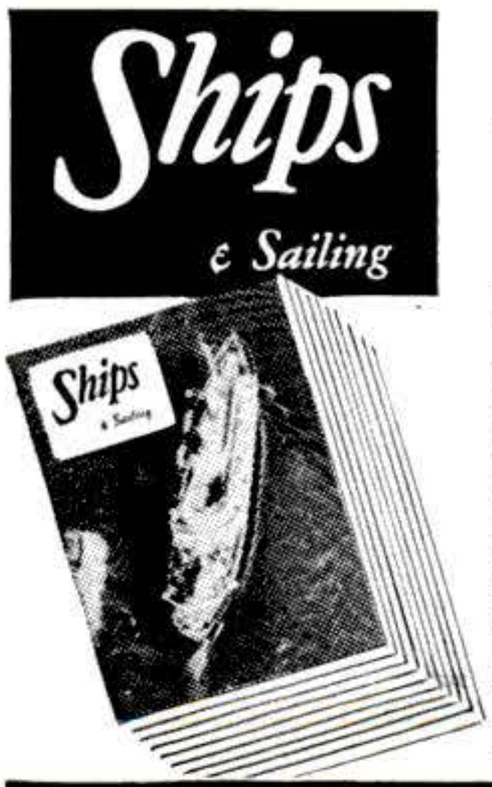

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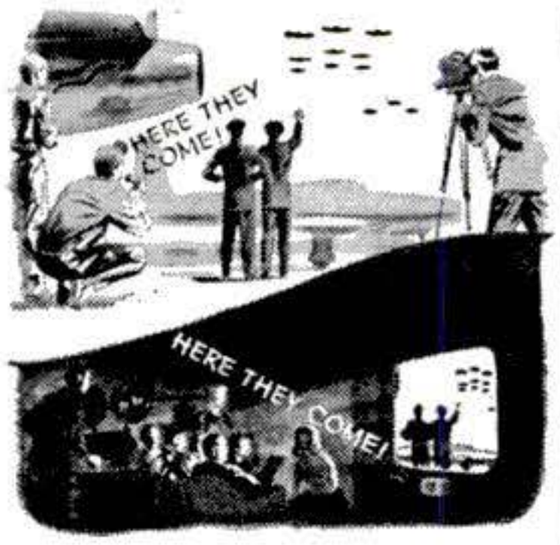

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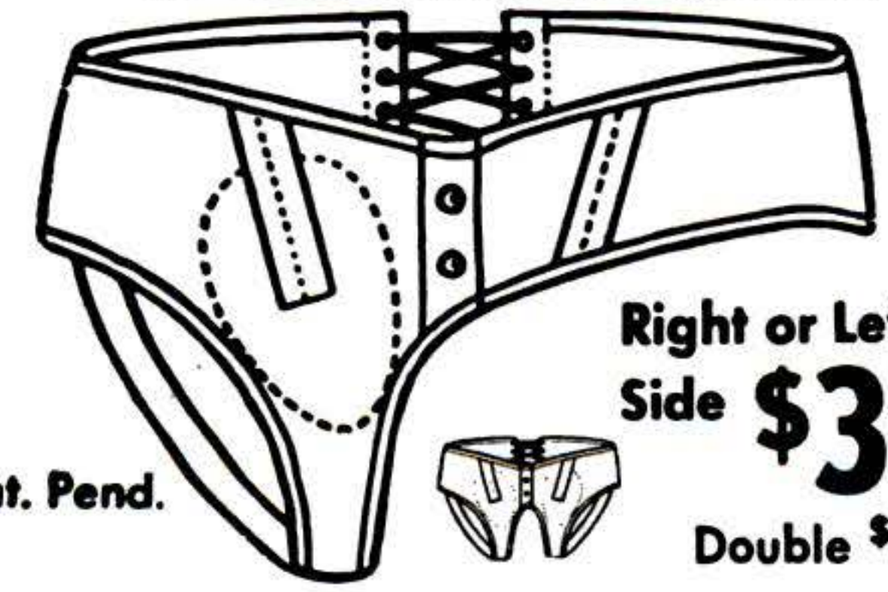

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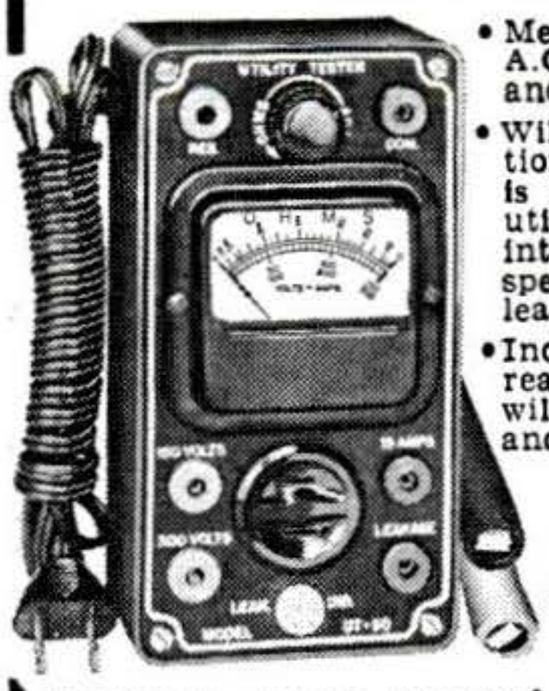

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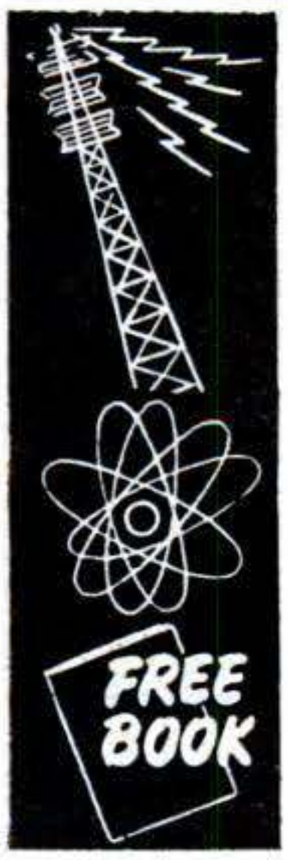

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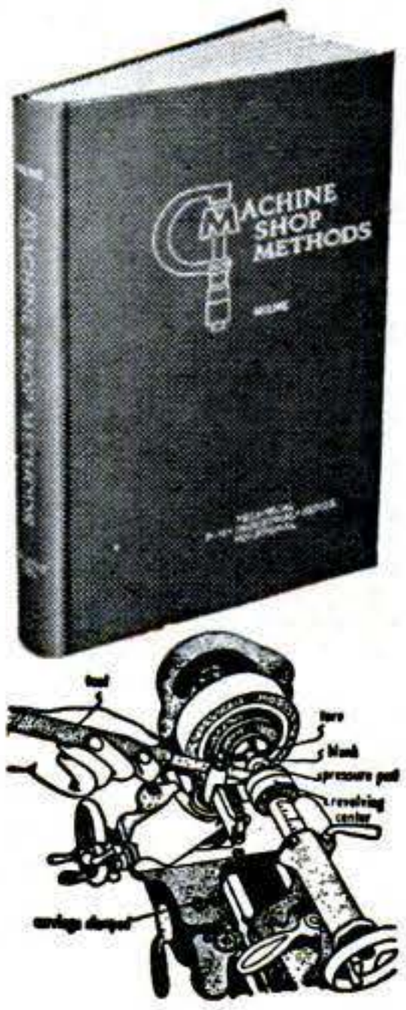

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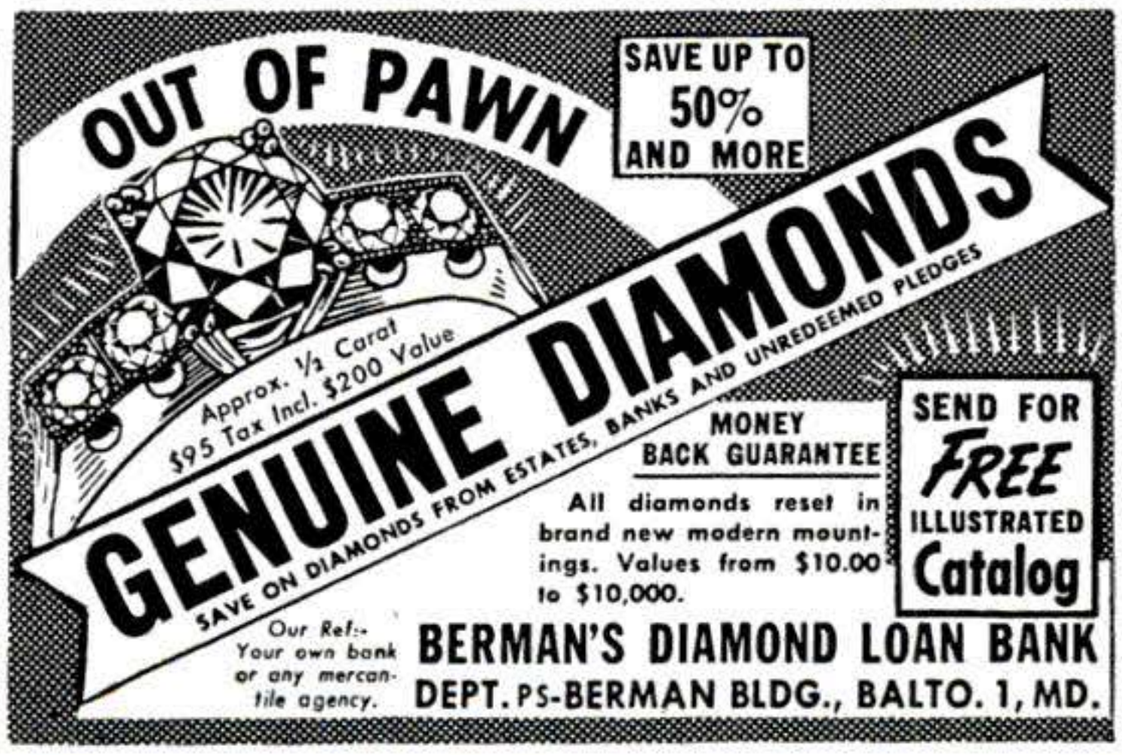

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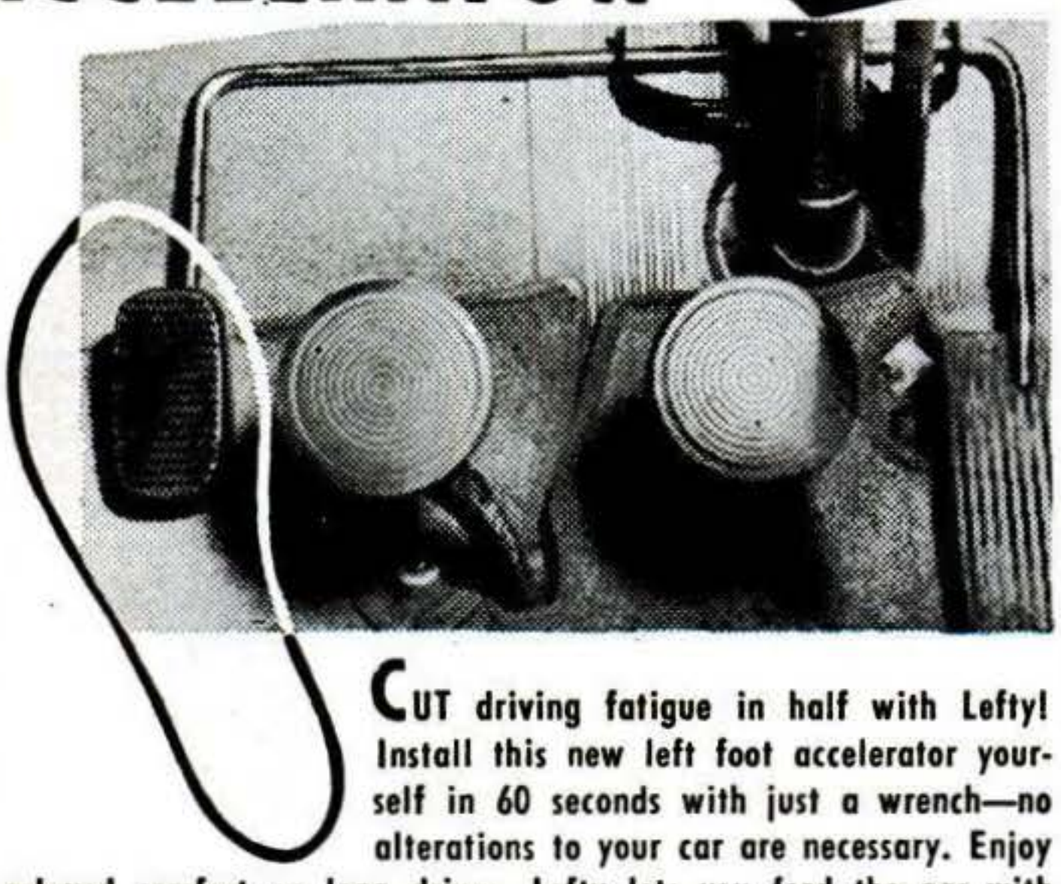

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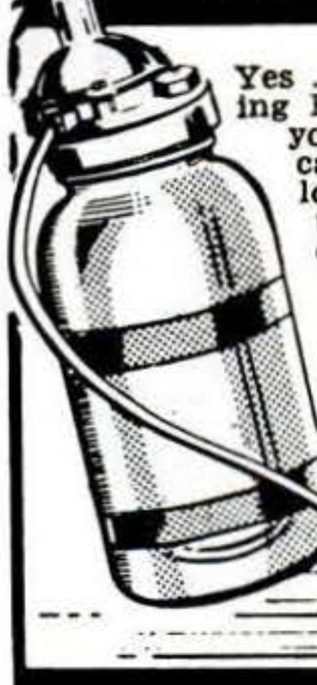

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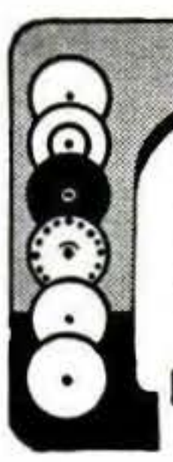

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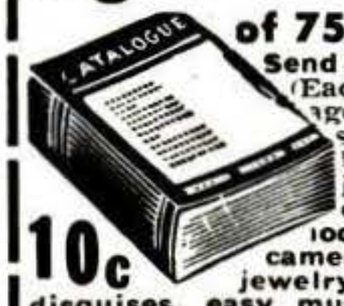

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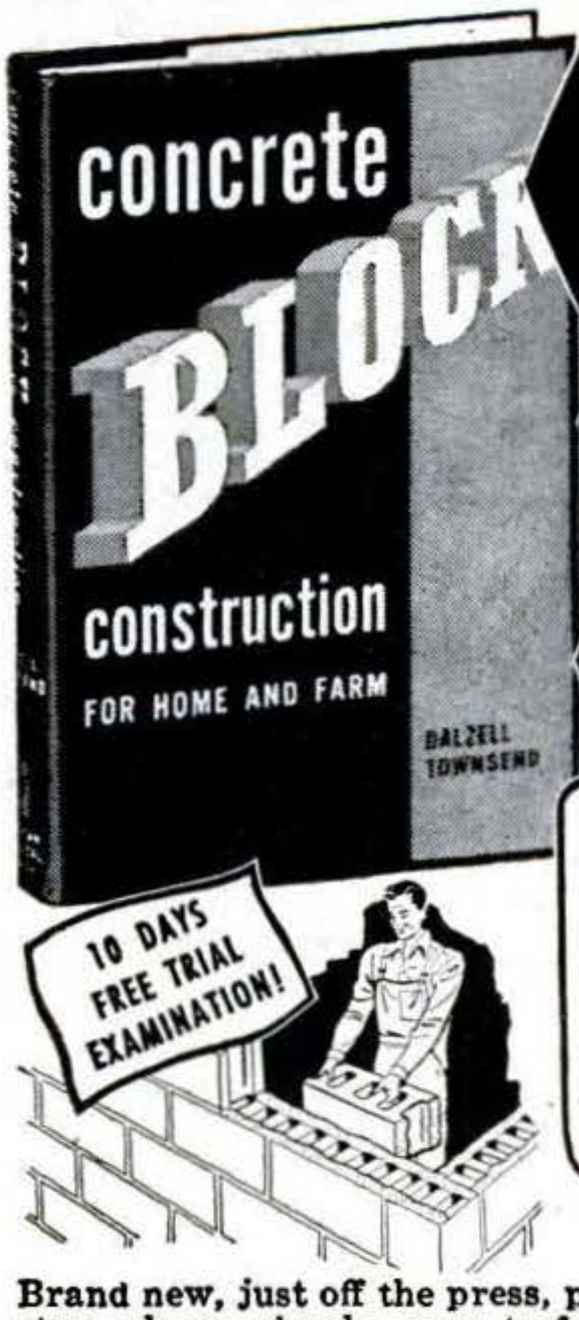

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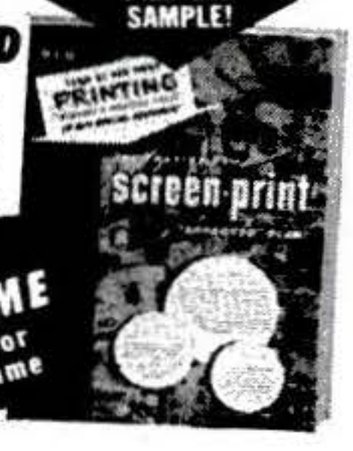

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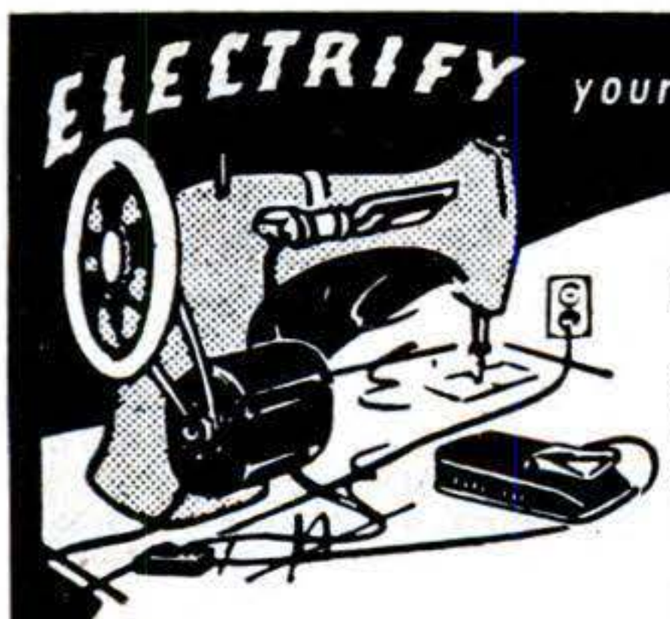

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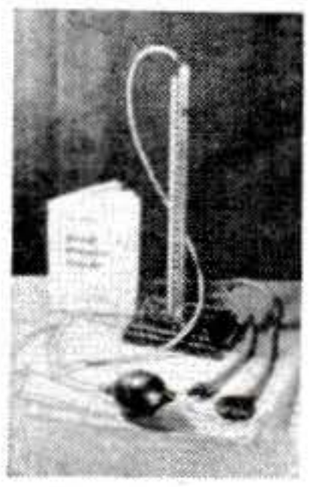

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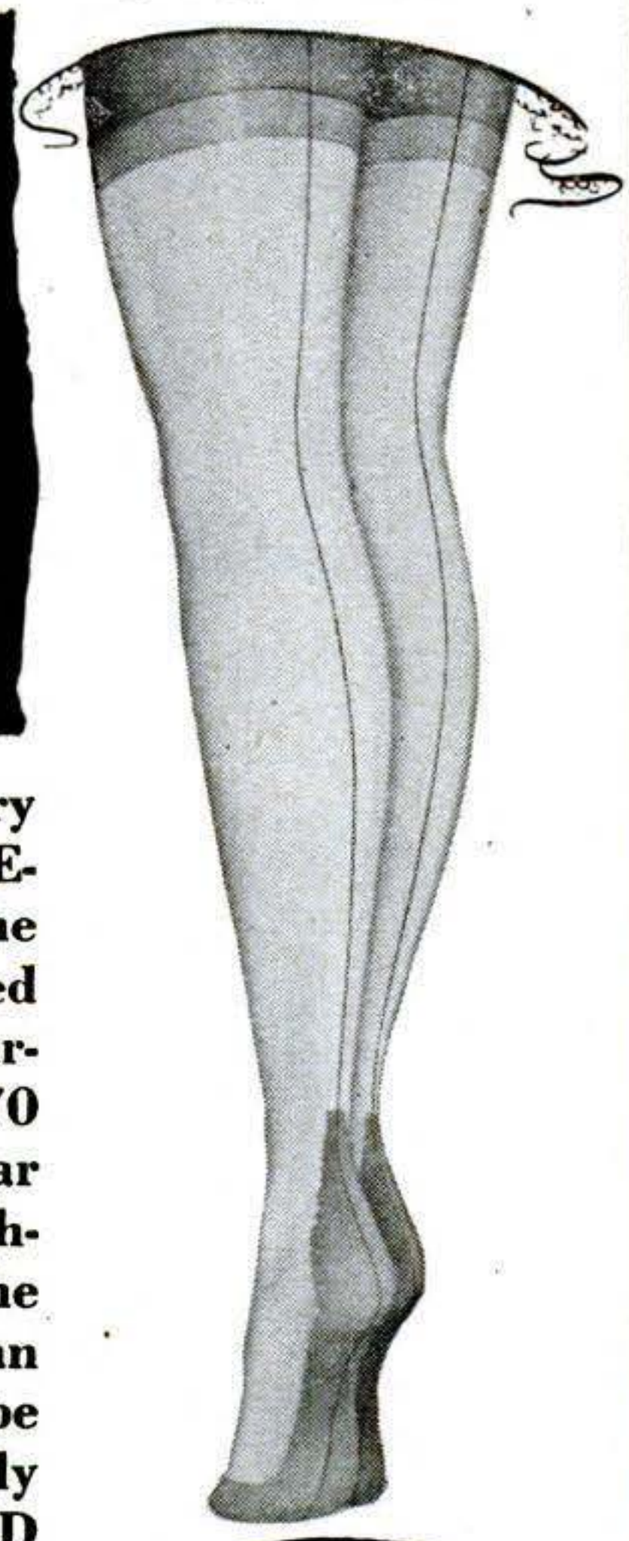

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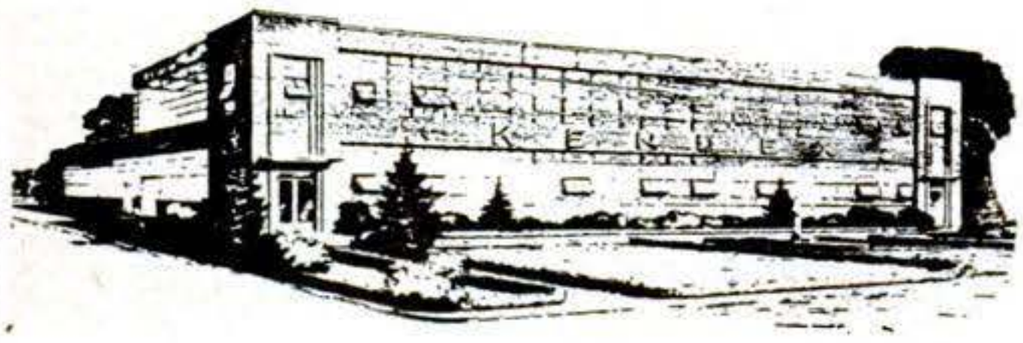

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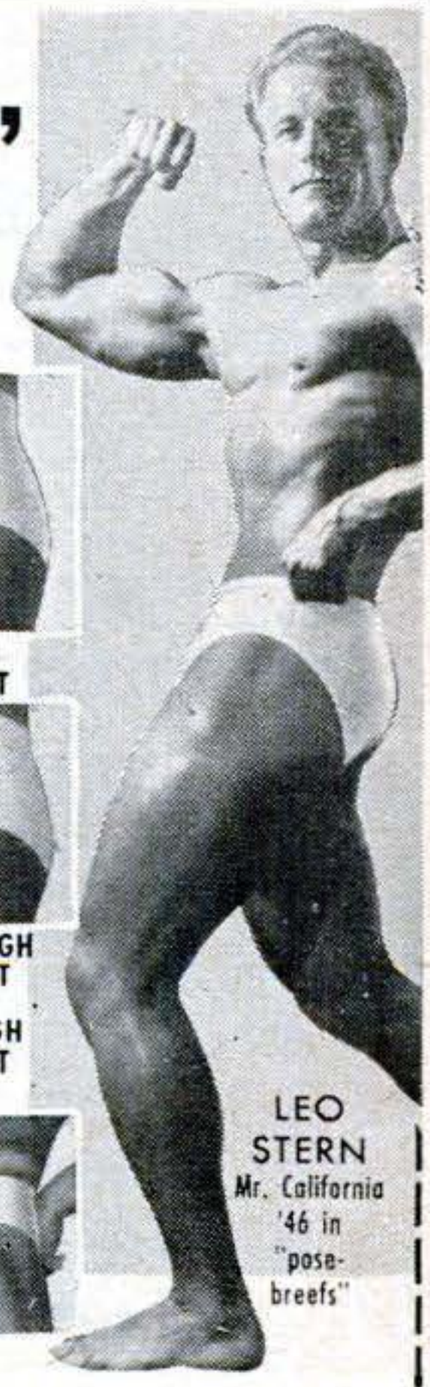

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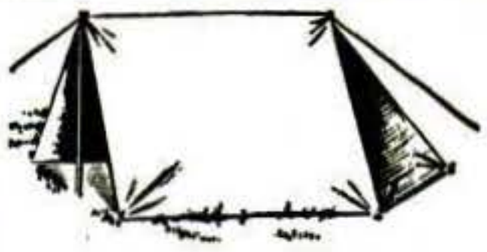

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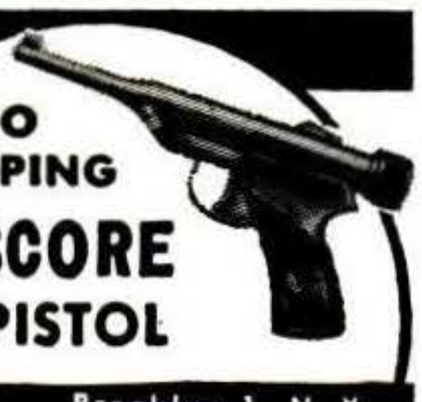

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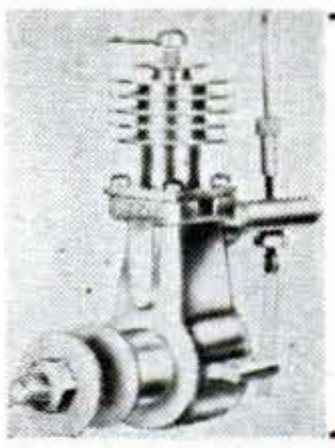

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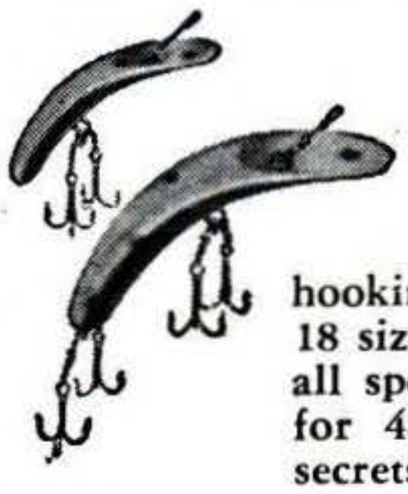

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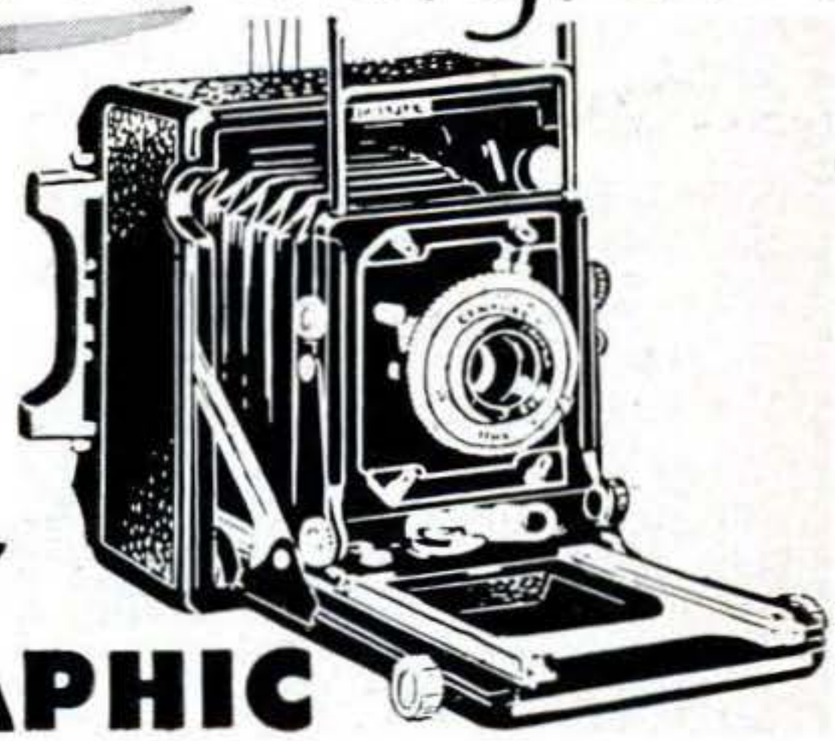

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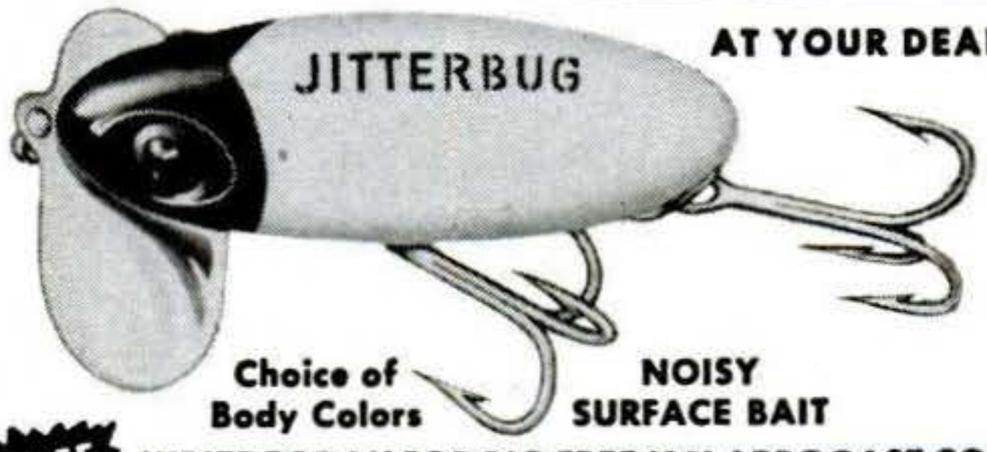

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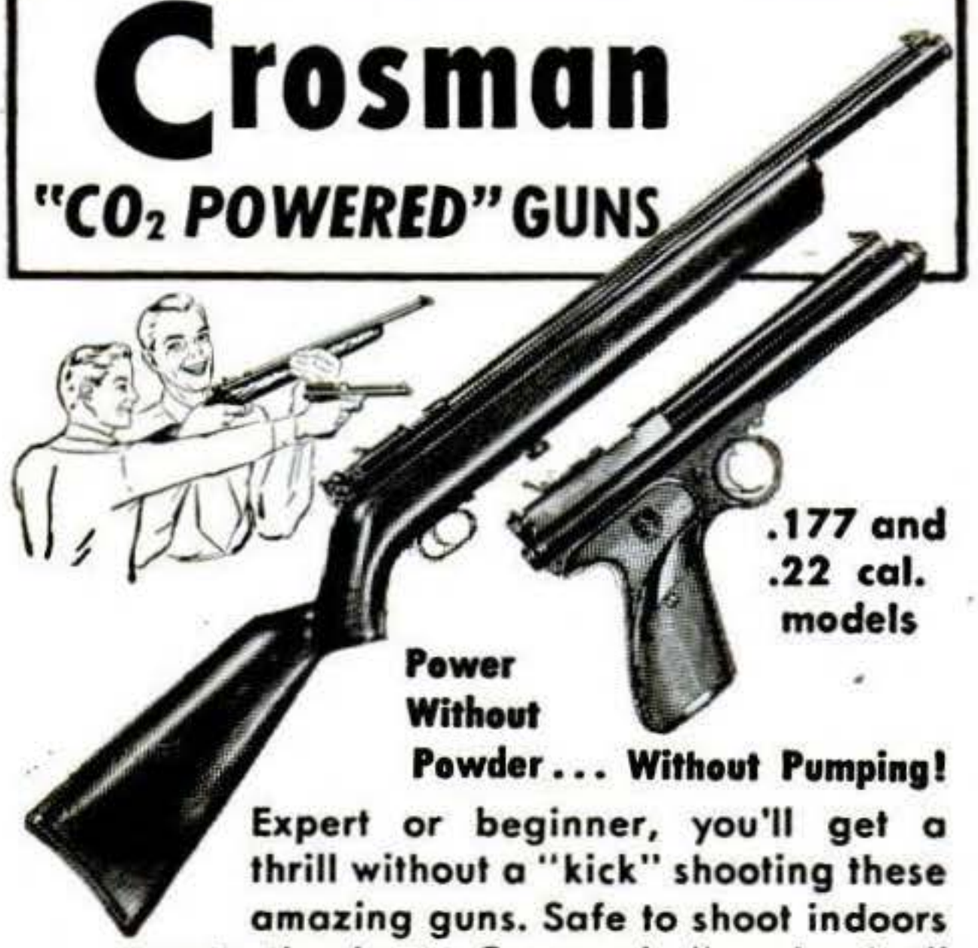

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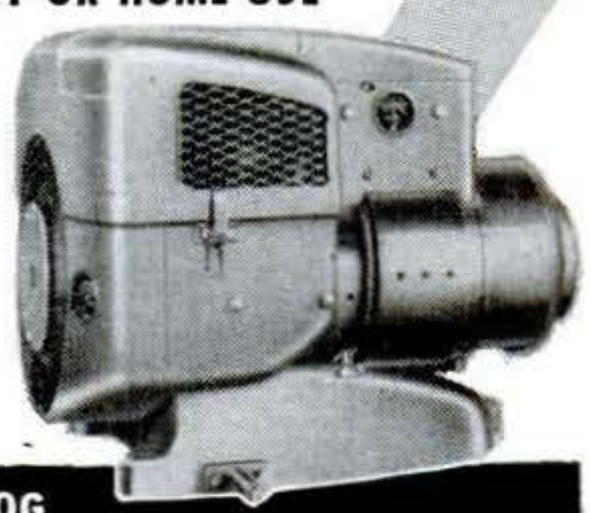

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

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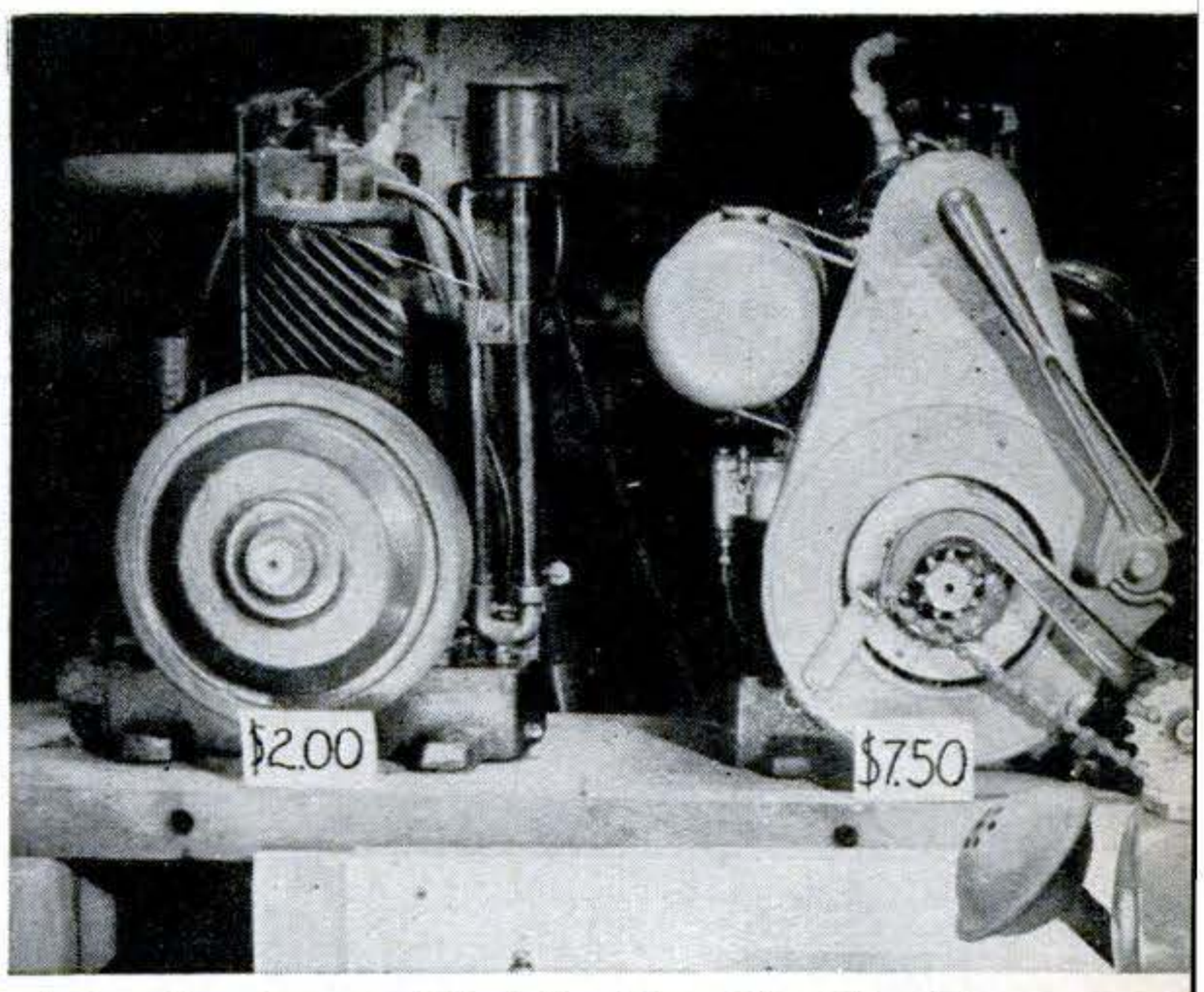
Popular Science *Highlights* This Month

The Kicker Grows Up. Did you know that the modern outboard motor develops more horsepower for its weight than a car? **Page 115**

TV Scheduled for Small Towns. Hamlets now off the video map may soon be using converters to tune in ultra-high-frequency telecasts. **Page 118**



Let a One-Lunger Work for You. Bought at bargain prices and overhauled, these one-cylinder engines are a cheap source of power. **Page 187**

Secrets of a Submarine Truck. The Army's Eager Beaver breathes, snorts—and runs—under water, but how does it do it? **Page 105**

Take the Sun Lying Down. This simple easy-to-loaf-in lounge chair folds up for carrying—but only when you want it to. **Page 182**

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REPORT FROM THE

DRIVER'S SEAT . . .

Oldsmobile for '51 has low silhouette, simple, flowing lines. Note clean, unadorned grille.

They've done a good shrouding job to direct air through the radiator and onto the engine. The chrome area is reduced—and that's a good thing, too, with chrome on the critical list.

Shaw Drives the '51 Olds

Higher compression and uncanny acceleration make the new Olds one of the hottest "stock-car hot rods."

By Wilbur Shaw

PS PHOTOS BY W. W. MORRIS

THE 1951 Oldsmobile answers a question that a good many motorists are asking: what's going to happen to high-compression engines if octane ratings drop because of the rearmament program?

Olds has a newly designed combustion chamber to maintain the advantages of high compression even with gas of lower quality. The company also has boosted the compression ratio of its Rocket engine from 7.25-to-1

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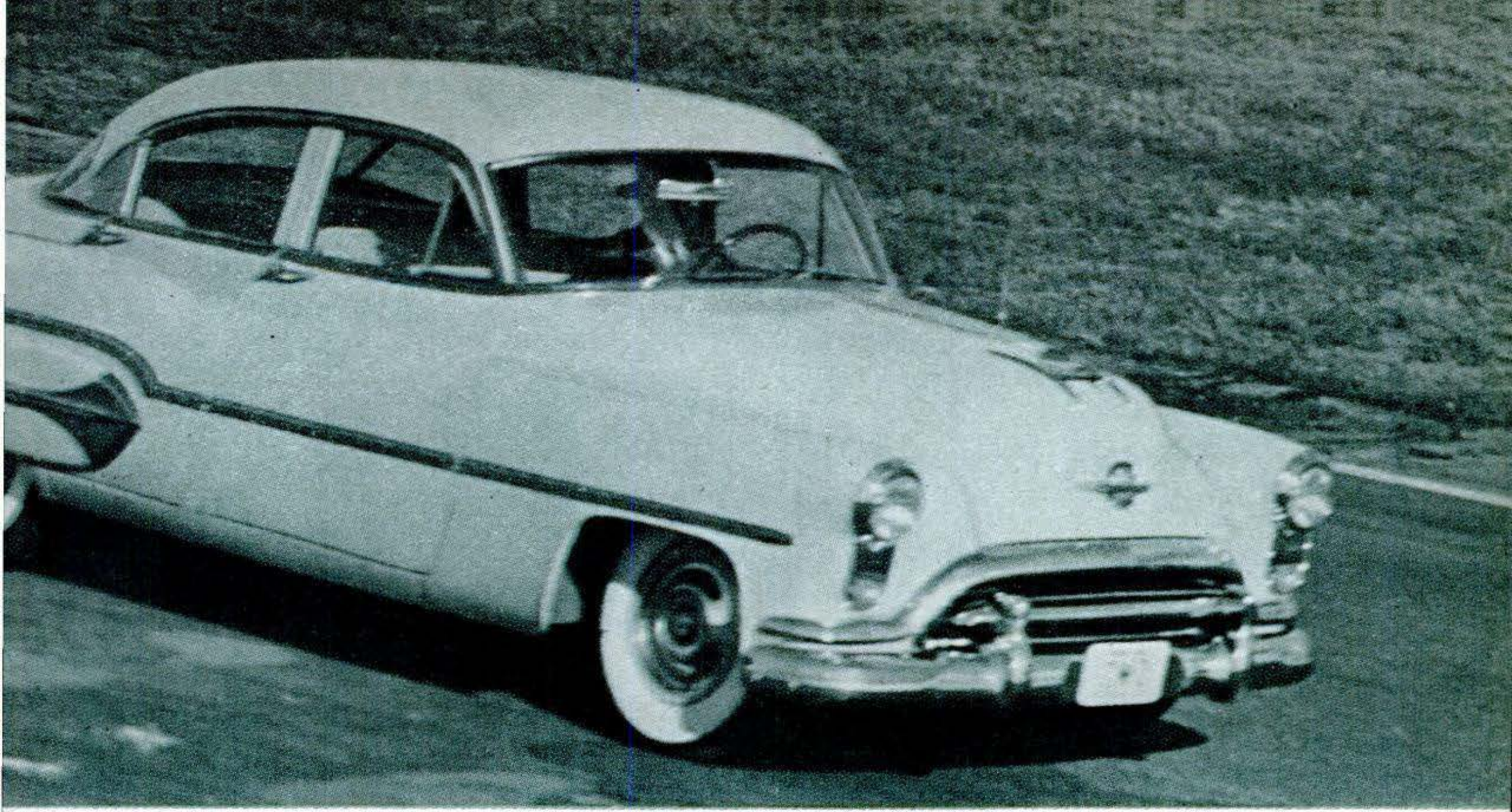

On the Indianapolis track, the acceleration of the Series 98 Holiday Sedan was astonishing.

to 7.5-to-1. Other changes include the substitution of leaf-type rear springs for coils, and a new reversing mechanism in the Hydra-Matic transmission to make "rocking" easier.

Olds, starting with the 1949 V-8 models, was one of the first of the "stock-car hot rods." Even today, with several spectacular stock jobs on the road—including the 1951 Chrysler that I wrote about in the April issue of POPULAR SCIENCE—the Olds remains one of the scattiest machines produced.

I had a taste of that on the trip to Key West in the Chrysler. I was rolling along the two-lane Key highway at a good clip when an Olds 88 crept up behind me. The road was clear. Just for fun, I let him come abreast of me to pass and then booted the Chrysler—just a second too late. The Olds got around me.

Moral: never underestimate the power of an Oldsmobile.

Having driven an Olds for two years, I climbed into a "98" Holiday sedan with Hydra-Matic drive, anxious to find out what Jack Wolfram, the company's brief-spoken general manager, had done to the car for 1951. This is the way my tape-recorded comments went as the engine began turning over on the "brick yard" in front of the grandstands at the Indianapolis Speedway:

Well, I can say one thing right now—the visibility in front is better . . . you sit high enough in this job to see enough of the road for safe driving . . .

I can't say as much for the visibility through the rear-view mirror . . . no matter how you adjust the thing . . . no matter how much you duck your head . . . you can't see all the road behind you . . . Even so, this is an improvement over the Olds convertible I've been driving . . . with the back curtain up, the only mirror worth a darn is the outside one . . .

Why is it that outside mirrors are always out of alignment?

I frankly don't know what the answer is to better rear visibility so long as manufacturers build their car silhouettes as they are today. But something ought to be done about it. Studebaker's rear-vision mirror mounted on the dash does a better job than one attached to the top of the windshield—if a rear-seat passenger doesn't get in the way.

I like this one-piece windshield . . . the quality . . . the glass quality is excellent . . . no noticeable distortion . . . but replacement would be expensive.

I slipped the lever on the steering-column selector quadrant into "Drive" for a turn around the track.

For anyone who drives a torque-converter transmission, Hydra-Matic klunks too much in going from neutral into Drive . . . that's it, a klunk . . . there's a fraction of a second delay before it takes hold, too . . . the creep at idle is excessive.

Even after the automatic choke had stopped kicking up the idling speed and the

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The center armrest for the rear seat is nice and wide. The Series 98 has extra-soft foam-rubber seat cushions. Since January, company has also introduced a roomier "Super 88."

Olds, I must say, is somewhat late in coming to it, but this recess in the back of the front seat, together with repositioning the rear seat, adds almost 2½ inches of leg room.

FACTS ON '51 OLDSMOBILE

Make and model: Oldsmobile Series 98 Holiday four-door de luxe sedan.

Engine: 8-cyl. valve-in-head; 135 hp. at 3,600 r.p.m.; car weight per hp., 28.04 lb.; bore and stroke, 3¾" by 3 7/16"; compression, 7.5:1; piston displacement, 303.73 cu. in.

Engine piston travel: (in feet per car mile at 20 m.p.h.) 1,496.

Crankshaft bearing surface: 50.6 sq. in.

Torque: 263 lb.-ft. at 1,800 r.p.m. (with bare engine); 255 lb.-ft. at 1,800 r.p.m. (with standard accessories).

Transmission: Hydra-Matic.

Rear-axle ratio: 3.64:1.

Steering ratio: 21.3:1.

Radius of turning circle: 21'.

Effective brake-lining area: 191.7 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 3,914 lb. including 42 lb. of factory-installed equipment; height (with five passengers), 62.31"; over-all length with bumpers and guards, 208"; width, 80.68"; wheelbase, 122"; front overhang, 34.74"; rear, 50.45"; tread, front, 59"; rear, 61.5".

Inside dimensions: seat-cushion width, front, 64.1"; rear, 64.82"; leg room, front, 43.59", rear, 42.26"; headroom, front, 35.61", rear, 35.37"; seat height, front, 13.65", rear, 12.28"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5.11"; front-seat adjustment, horizontal, 4"; vertical, .25".

Tire size: 7.60 by 15.

oil had warmed up, I had to keep a firm foot on the brake at a standstill while in Drive range.

The "98" gets away right now . . . even with my own well-worn Olds, I'm always . . . I'm always surprised how fast it accelerates in comparison with cars having other types of transmissions . . .

There's an indicated 60 . . . there's an indicated 60 miles an hour in exactly 13 seconds on a stopwatch.

Twice more I accelerated from a standstill. The car hit 60 in 14 seconds and again in 13 seconds. You can't ask much more than that from any automobile. It's why Oldsmobile owners are usually out in front when the light turns green.

A Hydra-Matic sort of pitches itself from one gear into the next in accelerating . . . the gear changes are smoother now . . . you feel the shifts, but they're a lot smoother than they used to be . . . what I don't *like about Hydra-Matic is the down-shifting.*

It's time for another smidgin of discussion on torque converters versus automatic-mechanical transmissions. You pays your money and you takes your choice. Both types cost gas. When you substitute automatic machinery for manual gear-shifting, you have to pay for the convenience.

By and large, torque converters, with or without help from a mechanical gear, have less scat from a dead start than Hydra-Matic. That's because it takes a second for the oil in the converter to get moving and multiply the torque effort of the engine. Hydra-Matic's simple fluid coupling and gears respond almost instantaneously when you step on the gas. In fact, it will jar your eye teeth if you try driving a Hydra-Matic

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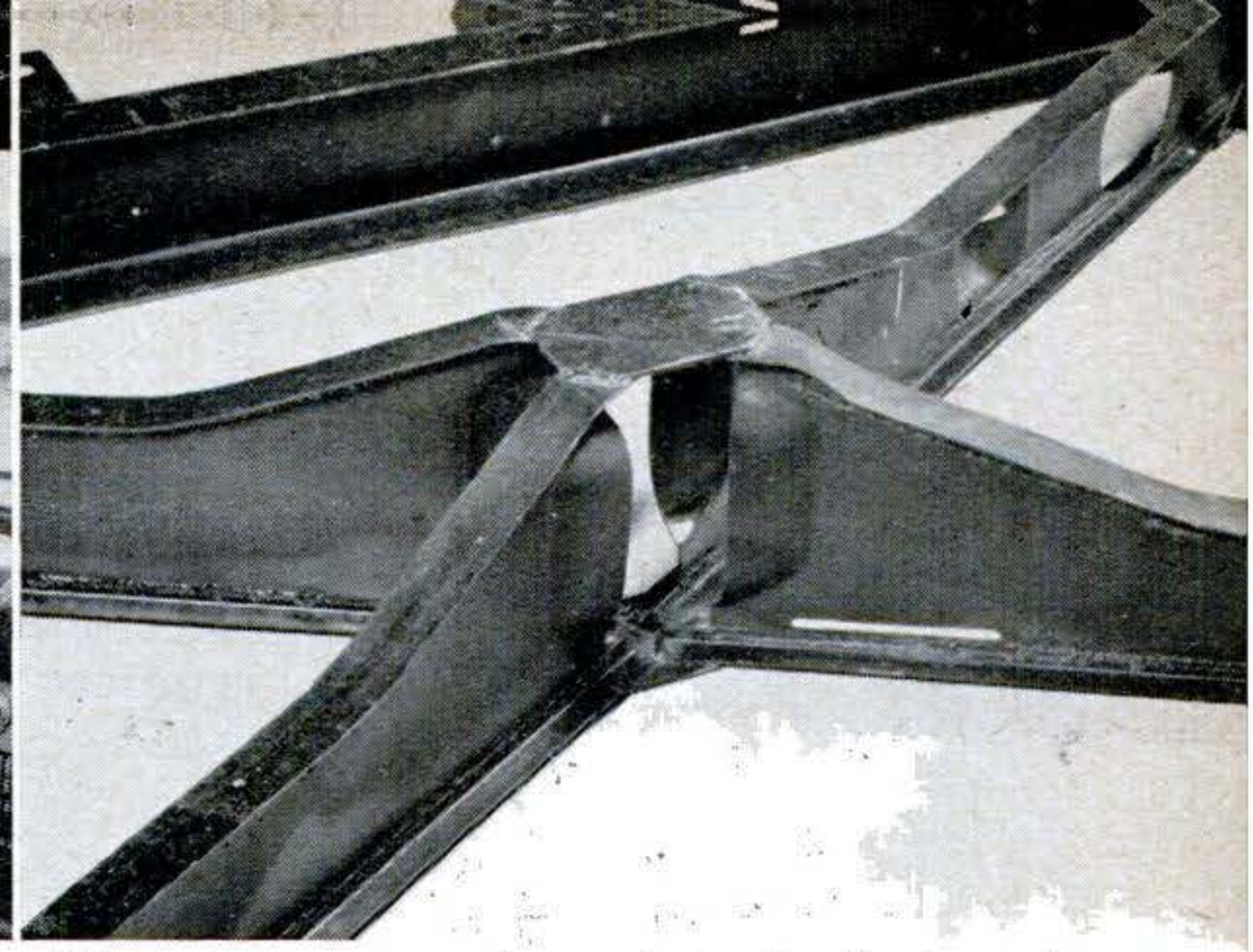
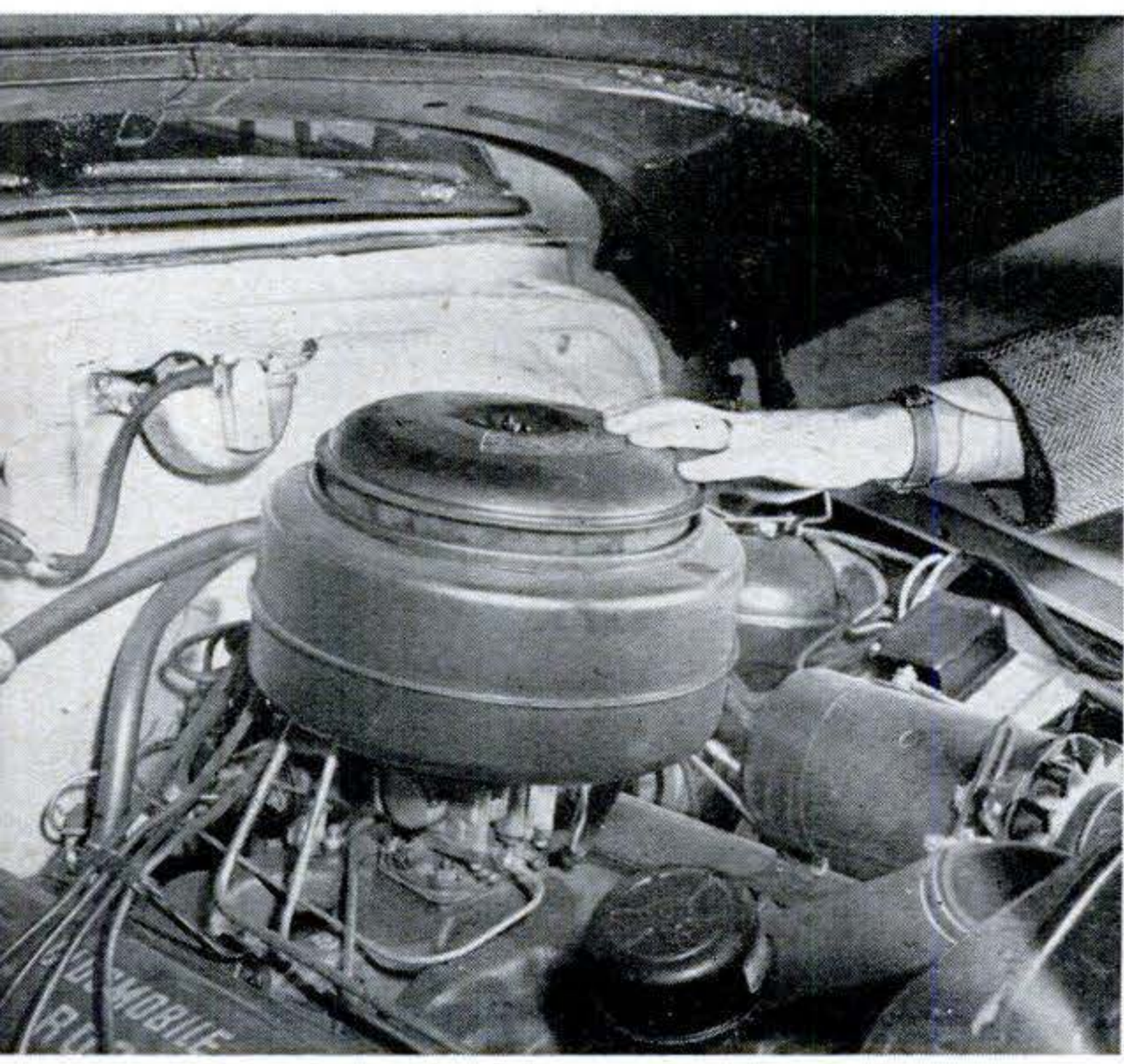
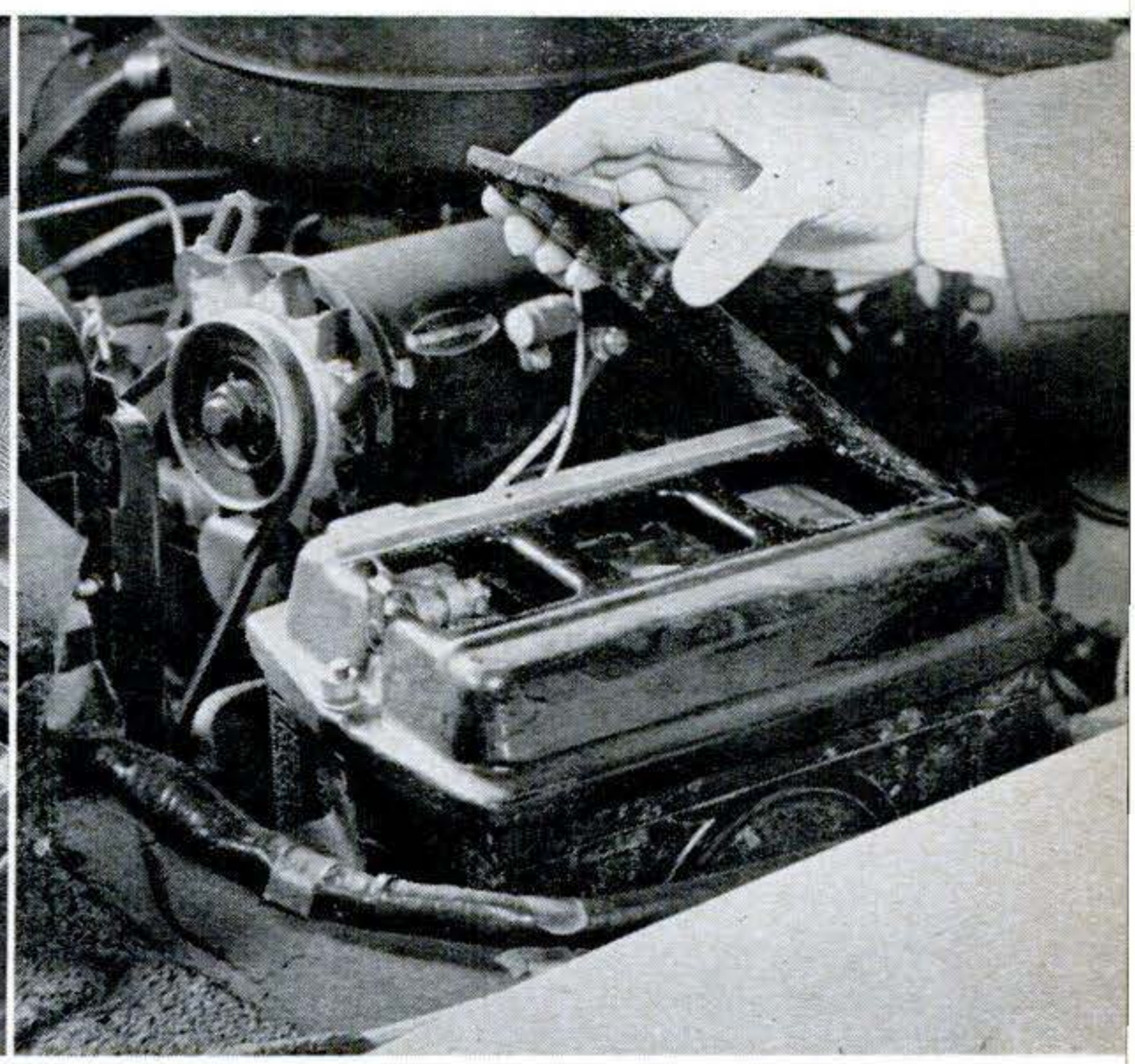
It's a good wheel. It doesn't obstruct your view of the panel. The glass shade, made by the Richard M. Decker Co., Chicago, is extra. The car was supplied to me by Roy Hickman.



I-beam cross members, instead of channel sections, make the frame much more rigid. Bodies are stronger, too. Olds had had trouble with breakage of their center posts.



The engine has a new oil-bath air cleaner and silencer. When the V-8s first came out, they pumped a little oil, but that's mended now with changes in piston and ring tension.



This battery-case cover guards against corrosion. Other improvements: better fuel combustion and a rear suspension that eliminates body dip in accelerating from a standstill.

as you would drive a torque converter.

The only way you can come near making a torque converter match the take-off of a Hydra-Matic transmission—now to be found in a lot of other cars, both with and without General Motors trade names—is to hold the brake, step on the accelerator, and then let go. And don't try that in the dark of the moon on a crowded highway.

One of these days I'm going to find out what a torque converter will do in such circumstances in Low Range.

Where the torque converter has it over Hydra-Matic is in the absence of down-shifting in deceleration. While the torque converter is smoother, the advantage is questionable—you don't get down-shifting, but you don't get much engine compression braking going downhill, either. Exceptions: the Packard and Studebaker lock-up types of transmission.

I find no tendency . . . this car simply does not want to wander in a crosswind . . . there is a wonderful, solid feel to it . . . as if you are sitting on a powerhouse under complete control . . .

The brakes are as good as I've ever used. From an indicated 60 miles an hour, I

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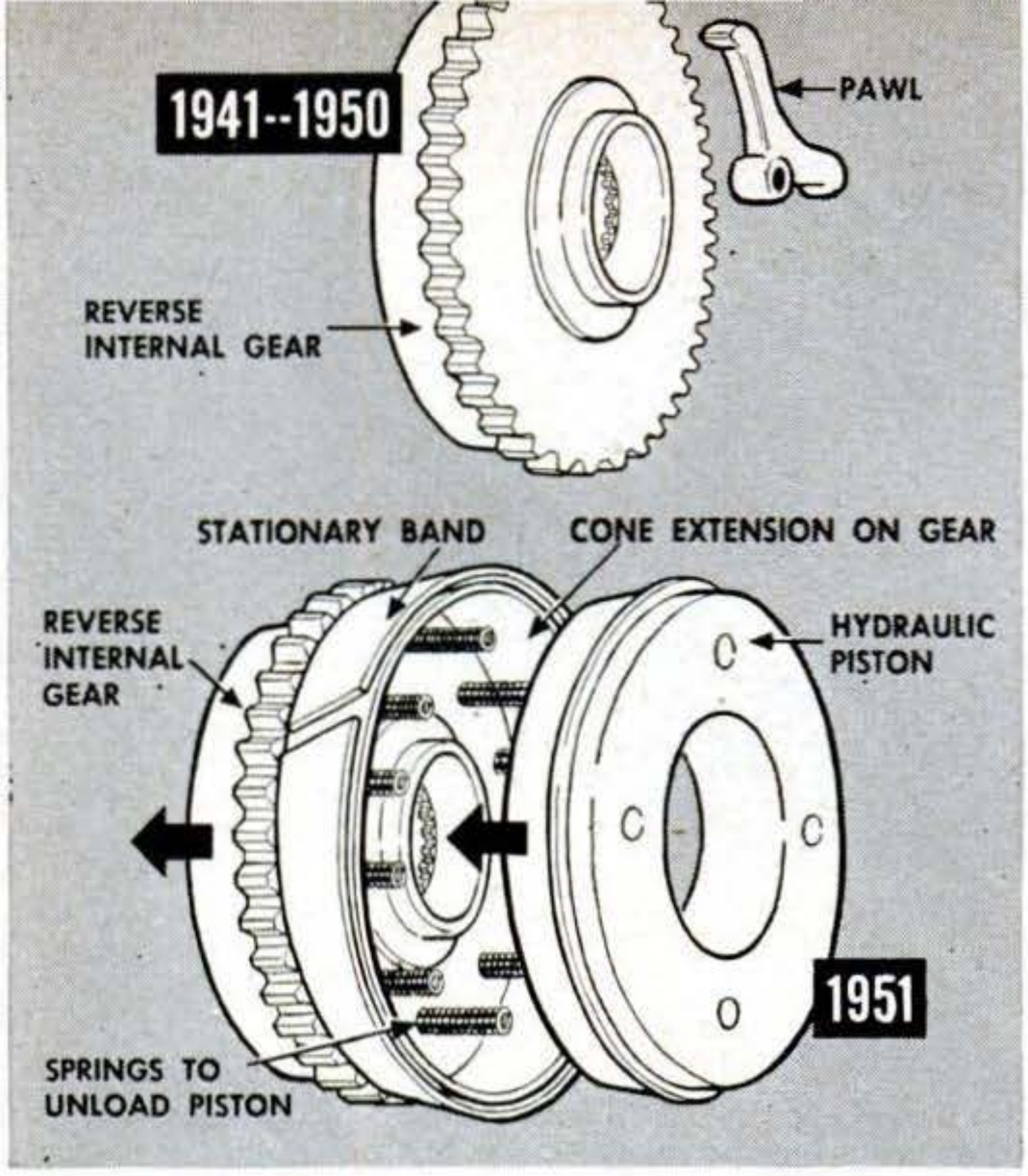

Biggest single engineering change is in method of getting into reverse. Heretofore a pull on gear-selector lever lodged a pawl in teeth of reverse internal gear. That locked gear and thereby reversed direction of rotation of output shaft. It also caused gear-clashing. Selector lever has to pass through Low Range to reach reverse. As it left Low Range, reverse internal gear began rotating. It took a quick hand to prevent clashing. Now gear is held by friction of hydraulic piston that pushes against cone extension on gear. This also forces cone against stationary band to increase friction and lock gear tight. This facilitates "rocking" because response is instantaneous and smooth. Pawl is retained but only for positive locking in parking on a hill.

braked to a stop, pressing just hard enough to get an incipient squeal. I measured the distance that it had taken to stop the car from the point where I had first pressed the pedal. It was 144 feet, 5 inches.

Adding 66 feet for the reaction time at 60 m.p.h. that the National Safety Council figures on, that was just 40 feet, 7 inches shorter than what the book says. There was no evidence of tire-rub on the pavement. The Olds felt completely stable under hard braking.

I'd heard a lot about a change in the reversing mechanism in Hydra-Matic for '51. So I brought the selector lever down to "R."

Reverse takes hold instantly . . . a lot quicker than on older Hydra-Matic models . . . they tell me you can shift to reverse with this at any forward speed under ten miles an hour without damage to the unit . . . so we'll try it . . .

And you can, you certainly can, and that's a pleasant surprise.

That's going to save the driver with butter fingers some repair bills.

The cornering qualities of this car are good . . . little evidence of sway in a sharp turn at 40 miles an hour . . . she keeps her feet on the ground . . . that's an improvement . . . undoubtedly due to replacing coil springs on the rear with semi-elliptics . . .

There's too much road vibration transmitted to the steering wheel . . . there should be better insulation against that.

On the track infield there is some pretty rough ground. I took the sedan over that at from 15 to 35 miles an hour.

The shocks are good . . . exceptionally good . . . nothing wrong in that department . . . they damp out spring oscillation after a bump very fast.

On the other hand, I found that in driving into the sun I got an excess amount of reflection from the surface of the shelf behind the windshield. It had an enamel-like black finish. Automobile manufacturers ought to dull-finish all such surfaces in the interest of safer driving.

There were a couple of other items that a motorist could criticize. An assiduous hunt along the panel failed to turn up more than one ash tray for occupants of the front seat. And the clock. Car clocks are annoying. They're always needing repair or their timing is off-beat. Yet they're standard in most custom cars. The clock in the Olds Holiday 98 sticks up like a sore thumb.

The parking brake was snugged in too nicely under the panel. You'd have to scramble to use it as an emergency.

On the happier side, all the instruments and controls were nicely centered. There was adequate room between the steering wheel and the left front door. The transmission and engine noises were low. So was the wind noise except when the vents were cracked about 5°. That causes a whistle, but no automaker has found a way to solve that one.

For my money, Olds had a good car. For 1951, they've got a better one. END

This Month's Shaw-ism

A car, like a wife, responds to attention.

Wilbur Shaw

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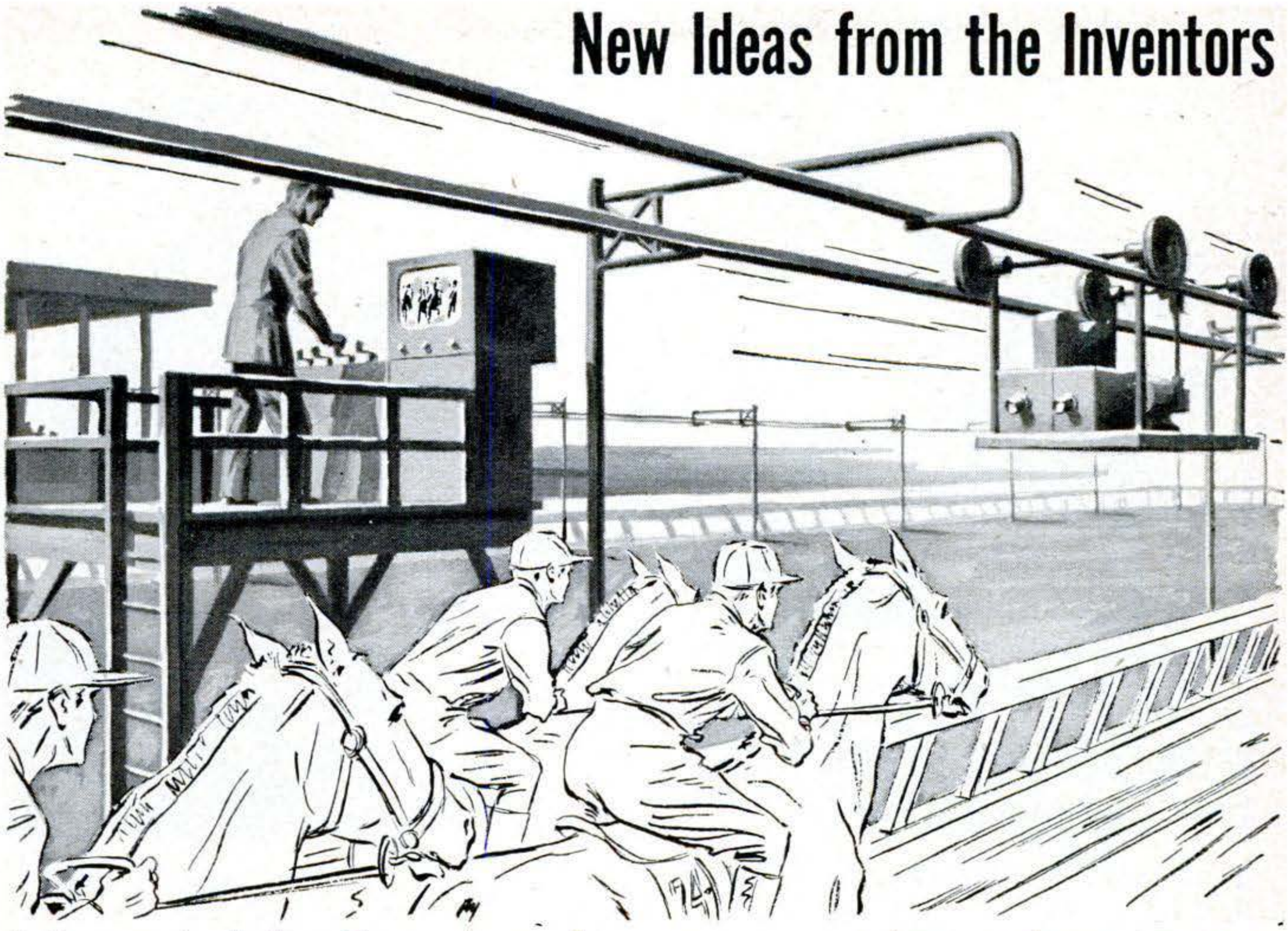
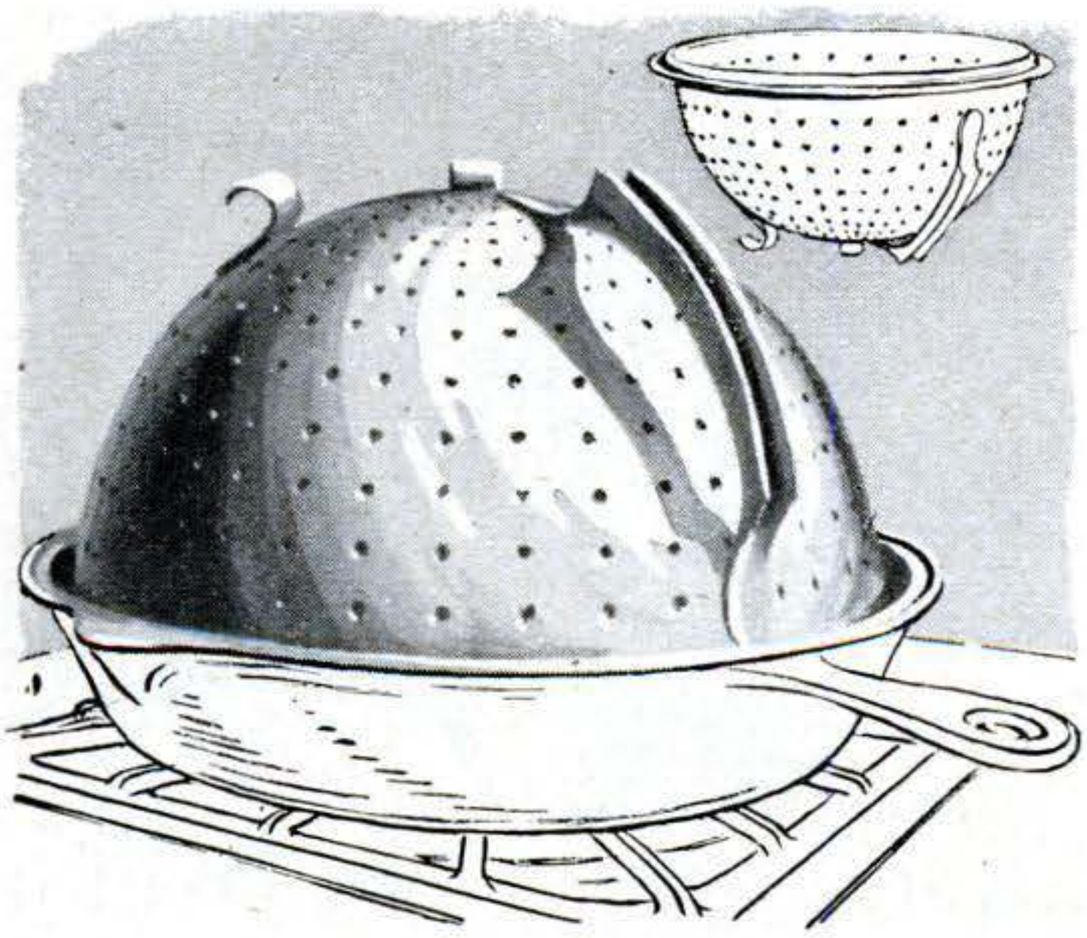
New Ideas from the Inventors



1 Camera to Follow Races. A complete motion-picture record of a horse race could be made with this remotely controlled camera that travels around the track on rails, just ahead of the horses. A television camera mounted next to the motion-picture camera serves as a view finder so that the remote operator, watching a TV screen, will know how to control the camera-carriage speed to keep the horses in view.



2 Skillet Cover to Do Double Duty. This dual-purpose kitchen utensil could be used as a pan cover when frying foods or as a colander when straining vegetables and similar foods. It is provided with a handle and also with two side extensions, or lips, to cover the pouring spouts on the frying pan when used as a cover.

3 Suit to Air-Cool Flyers. Keeping the pilot of a high-speed plane cool now requires cockpit coolers that take up considerable space and add weight. This air-conditioned suit would be cooled through ducts built into an insulated lining. Because the refrigerating unit would only have to pump cool air into the suit, it could be very small.

Turn the page, please, for three more new ideas.

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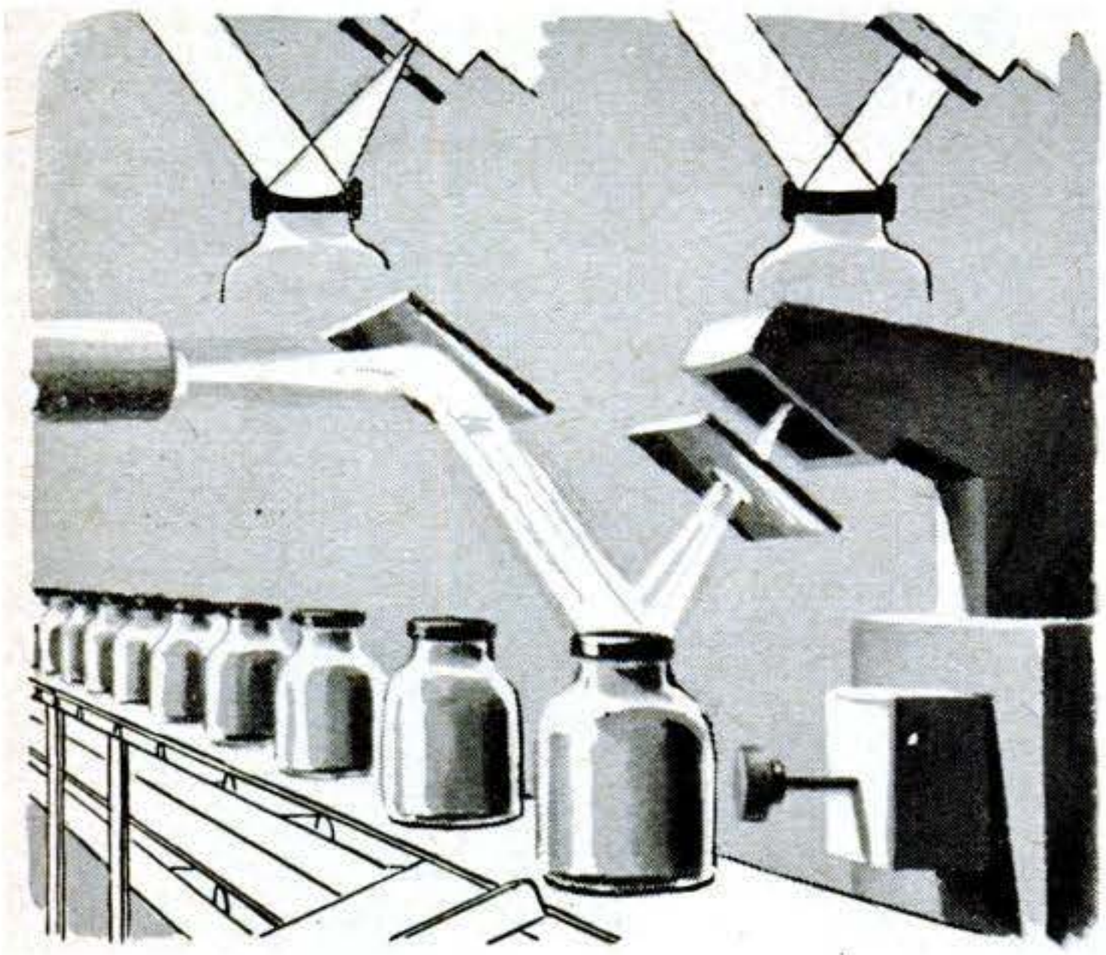
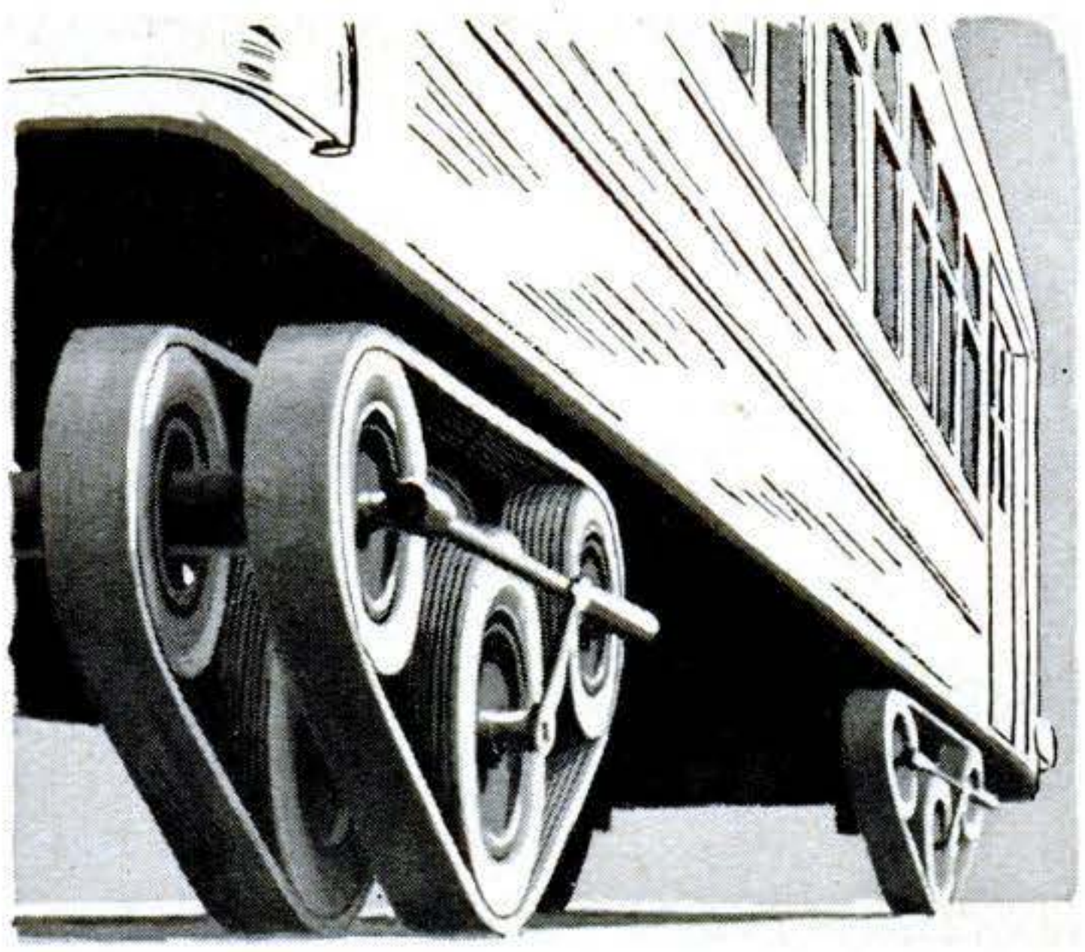
MORE New Ideas from the Inventors

4 Pellets to Help Clean Cars. High-pressure water and soft pellets would remove the mud and grime from a car in this cleaner. A hood would be lowered over the car, and then water sprayed from all directions, creating turbulence that hurls soft wads of kapok or similar material against the car. The wiping action of flying kapok wads would help remove the dirt. Later, the wads could be gathered up for reuse.



5 Light Beam to Check Vacuum Jars. This automatic checker uses the fact that the tops of properly vacuum-packed containers are curved in slightly. A light beam striking the lid of such a container is focused on a photocell. A flat lid, which means poor vacuum, won't focus the beam, so the cell operates a rejecting mechanism.



6 Tracks to Replace Bus Wheels. Because the wheels on a bus require wheel wells that cut down the seating space, this inventor suggests that the wheels be replaced with low endless tracks. An engine in the rear would power the rear bogies. A conventional steering gear would guide the front tracks directionally.

Patents on these inventions have been granted to: 1. M. Miller, Los Angeles; 2. J. Presenti, San Francisco; 3. L. Rodert, Cleveland; 4. K. Dye, Marine City, Mich.; 5. J. Razek, Llanerch, Pa.; 6. N. Focht, Syracuse, N. Y.

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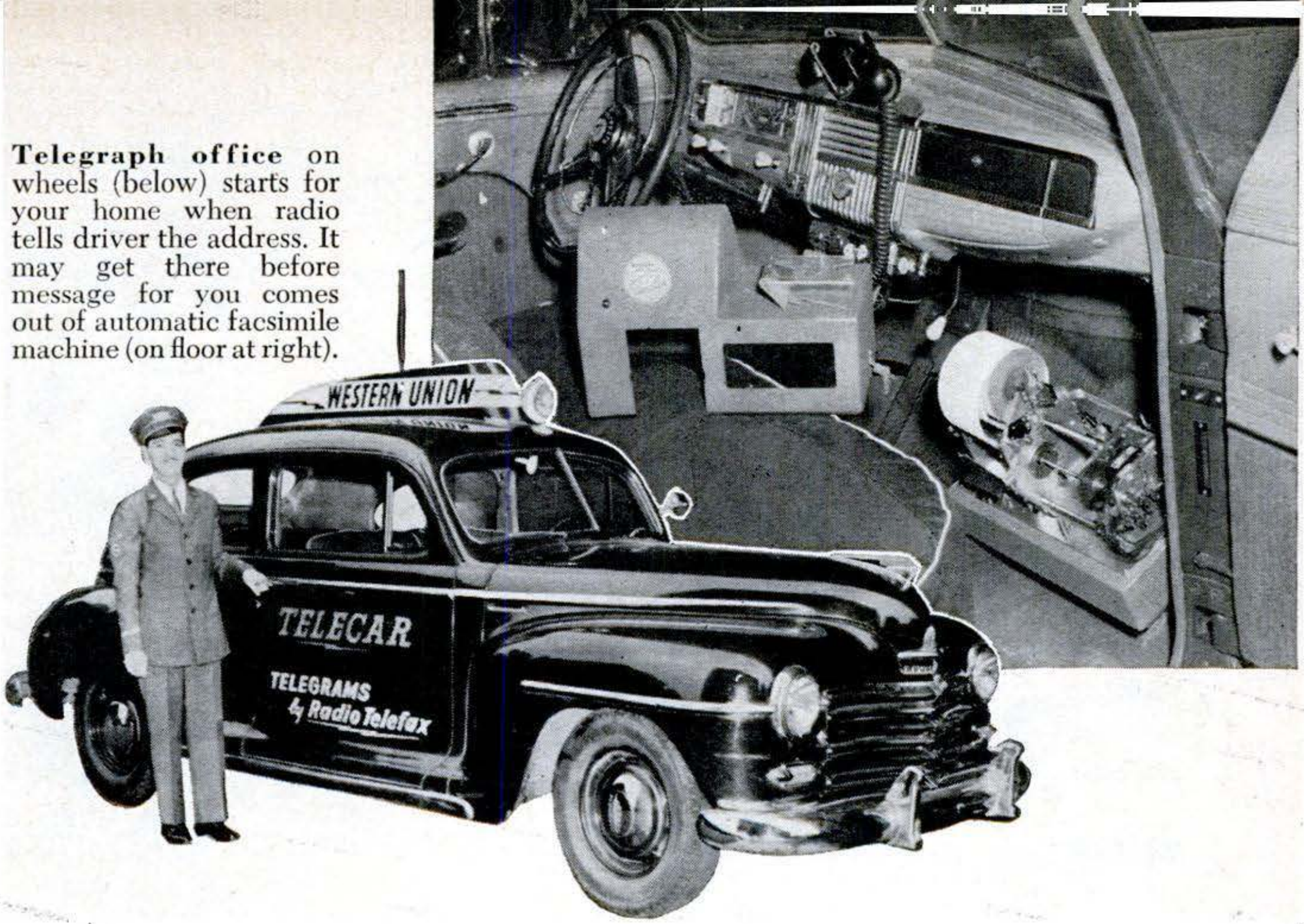
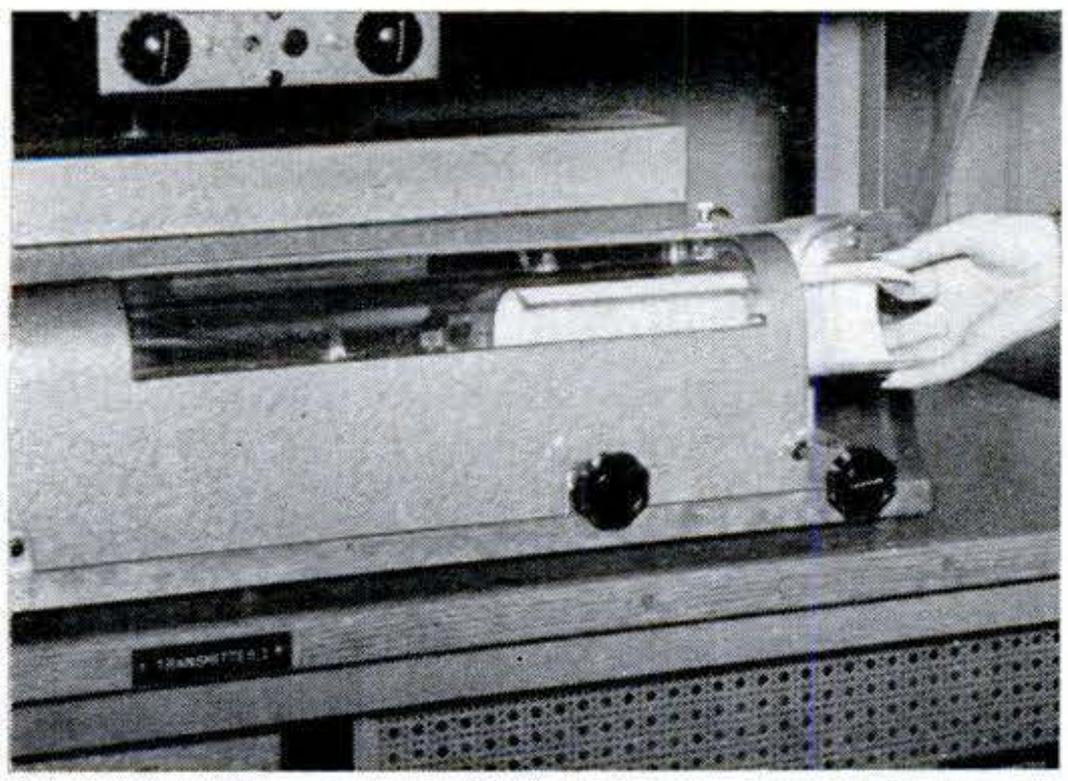
Telegraph office on wheels (below) starts for your home when radio tells driver the address. It may get there before message for you comes out of automatic facsimile machine (on floor at right).



Facsimile Car Delivers Telegrams

TELEGRAMS may not have to be delivered any more—they'll be *received* practically at your front door. Mobile telegraph offices that can reach your address while the message is still coming in are now being tested. Western Union calls them Telecars. They are prowl cars equipped with two-way voice radio and a radio facsimile receiver.

When a telegram intended for you is received at the main city office, it is retransmitted by facsimile to the prowl car in your neighborhood. The Telecar driver, already notified of your address by radio, might get to your house even before the message pops out of his facsimile machine.



Another facsimile development is this high-speed transmitter, part of world's fastest system, which can send 90-page magazine in an hour. It is not intended for use with Telecars.

The Telecar can deliver wires twice as fast as a motorized messenger operating from an ordinary office, and it can handle twice as many. In one case a telegram reached a suburban home only 17 minutes after it had been sent from a distant city.

The Telecars—standard sedans or station wagons—are loaded down with equipment. The facsimile receiver is small, but requires a separate control unit, an extra heavy-duty battery, and a special engine-driven generator and rectifiers to keep the battery charged. The two-way radio is a standard automobile set operating on the same channel as the facsimile machine.

The rolling facsimile service is now being tested in Baltimore. The whole city is covered by a fleet of seven prowl cars receiving messages from four transmitting stations. If this system works as expected, it may be extended all over the country.

At the same time neighborhood delivery facilities are being improved by the mobile office, central-office operations may also be speeded by another facsimile development. This is a new high-speed system—the fastest over-all communications method yet devised—that turns out ready-to-deliver copy at the rate of 3,000 words a minute. END

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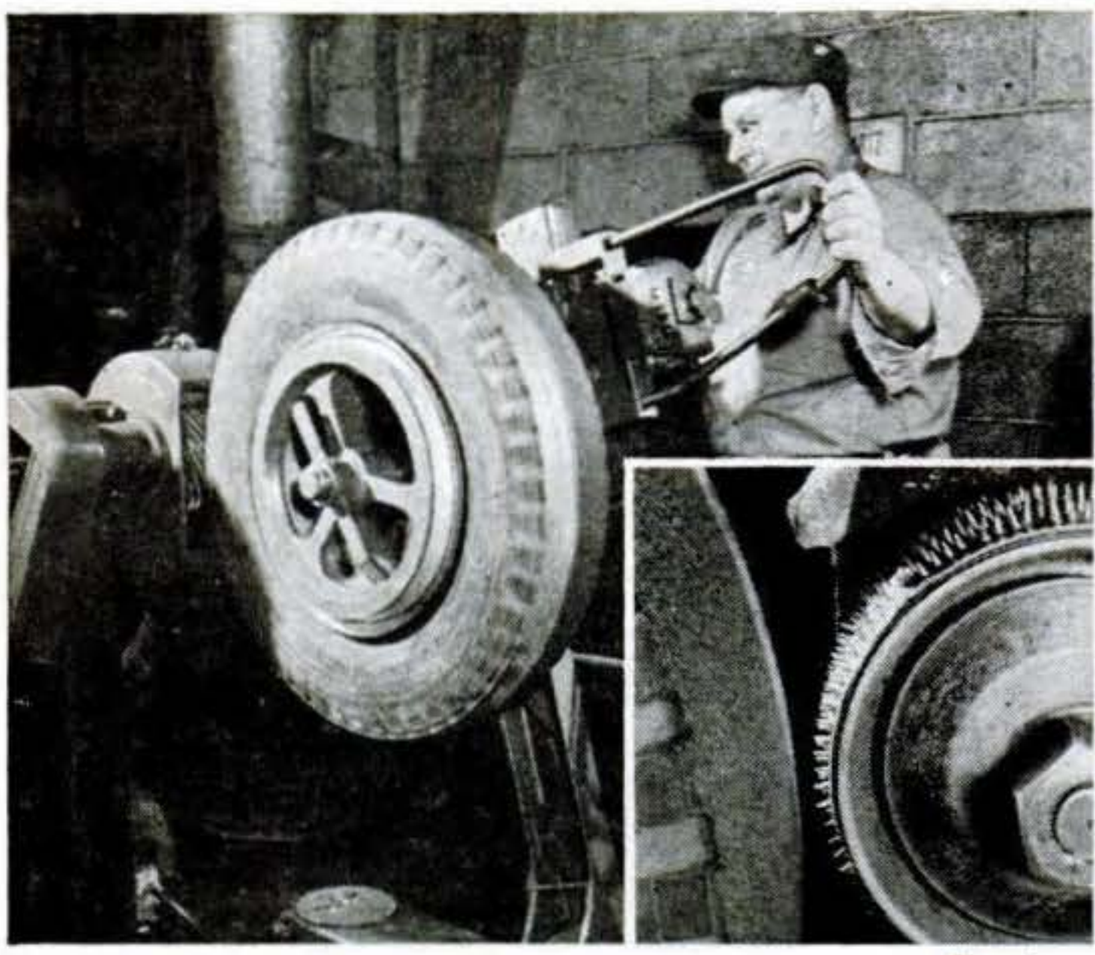
How they differ. For a retread, all old tread is removed and a wide-wing camelback is put on. For both types of capping, the original tread rubber is roughened with a rasp. Then a short-wing camelback is used for a full recap, and bevel-shoulder stock for a top cap.

Inspection weeds out defective casings. Like a doctor, the tire inspector uses a stethoscope. Passing a high-frequency vibrator over the casing, inspector listens for a hollow-log sound that reveals hidden ply separation, and tire is junked. Spreading tire as above shows up fabric breaks and cuts.

How Tires Are Recapped

PS PHOTOS BY HUBERT LUCKETT



1. Rasping of tread starts recapping procedure. Tire whirls against revolving rasp with tacklike teeth (inset). To guard rasp, nails and glass are picked out during inspection.

2. Vulcanizing cement, rubber dissolved in a high-test solvent, is stippled on the buffed surface. Then the tire is placed on a drying rack and left until the cement becomes tacky.

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5 WAYS TO SAVE YOUR TIRES

- **Drive carefully.** Start and stop slowly, and take it easy on turns, or pavement will wear off rubber. Keep off gravel and all rough roads. Avoid bumping or scraping curbs. This damages casing. Curb feelers will help.

- **Keep the pressures up**—but not too much. Both over- and underinflation shorten the life of a tire. Check pressures once a week or oftener with a good gauge while tires are cold. Keep caps on all valves.

- **Check front wheels regularly.** Caster, camber, and toe-in are all critical adjustments. Unless they're right, tires wear rapidly. Also keep brakes equalized. If one grips before others, tire may slide.

- **Rotate the tires** at intervals specified in the car's manual. Have wheels balanced with lead weights after each switch. If tire is taken off, put back in same wheel-to-drum relationship—or else rebalance wheel.

- **Inspect tires frequently** for glass or tacks embedded in rubber and stones and other objects wedged in tread. Pry these out. If you find deep cut, patch may save tire. Clean off oil and grease promptly.

Ban in Effect On Spare Tire For New Cars

Civilian Rubber Is Cut by 1,500 Tons a Month, Does Not Bar 5th Tire Purchase

WASHINGTON, April 2 (AP).—The government today ...

By R. P. Stevenson

CONSULTING the tire doctor before it's too late will help you keep rolling even though rubber is scarce. A recap or retread may double tire mileage if it is expertly done before serious casing damage has occurred.

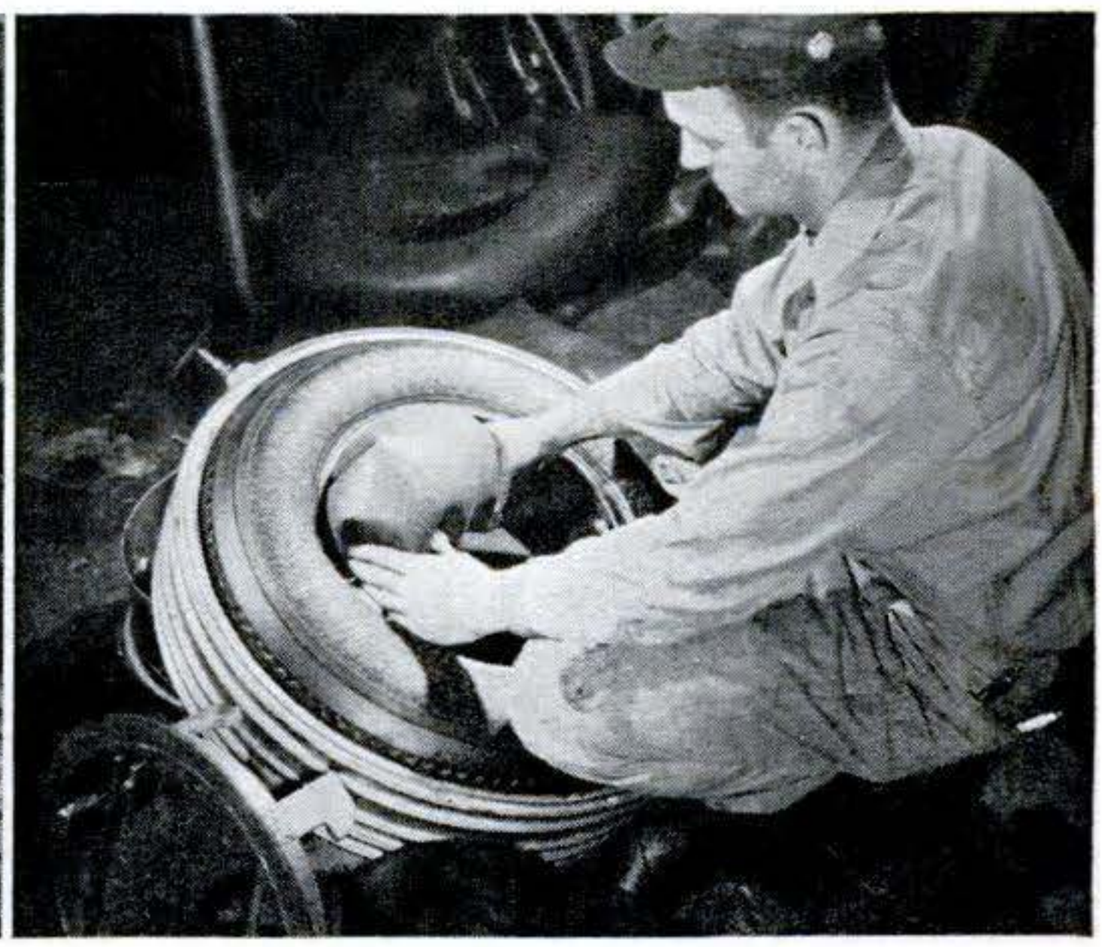
Such repairs also save you money. Rubber men say the casing represents two thirds of the original cost of a tire.

But only sound casings should be repaired. Fabric breaks, ply and tread separation, long cuts, and bad radial cracks are all reasons for junking a tire.

The best time for a recap is while traces of original tread still show. If wear goes deeper, retreading may be needed. For this, all old tread is removed.

These photos show how top-capping—the most practical recap job—is done by the Kraft system—Hawkinson method at the New York General Tire Company's shop.

3. Building up is what tire men call applying new tread rubber. This comes from roll of rubber stock behind worker. Ends are cut to a mating bevel and joined with tread gum between.



4. Ordinary tube exerts pressure inside tire while it's curing. Here, tube is being inserted after the steam-curing band has been slipped on tire.

[*Continued on next page*]

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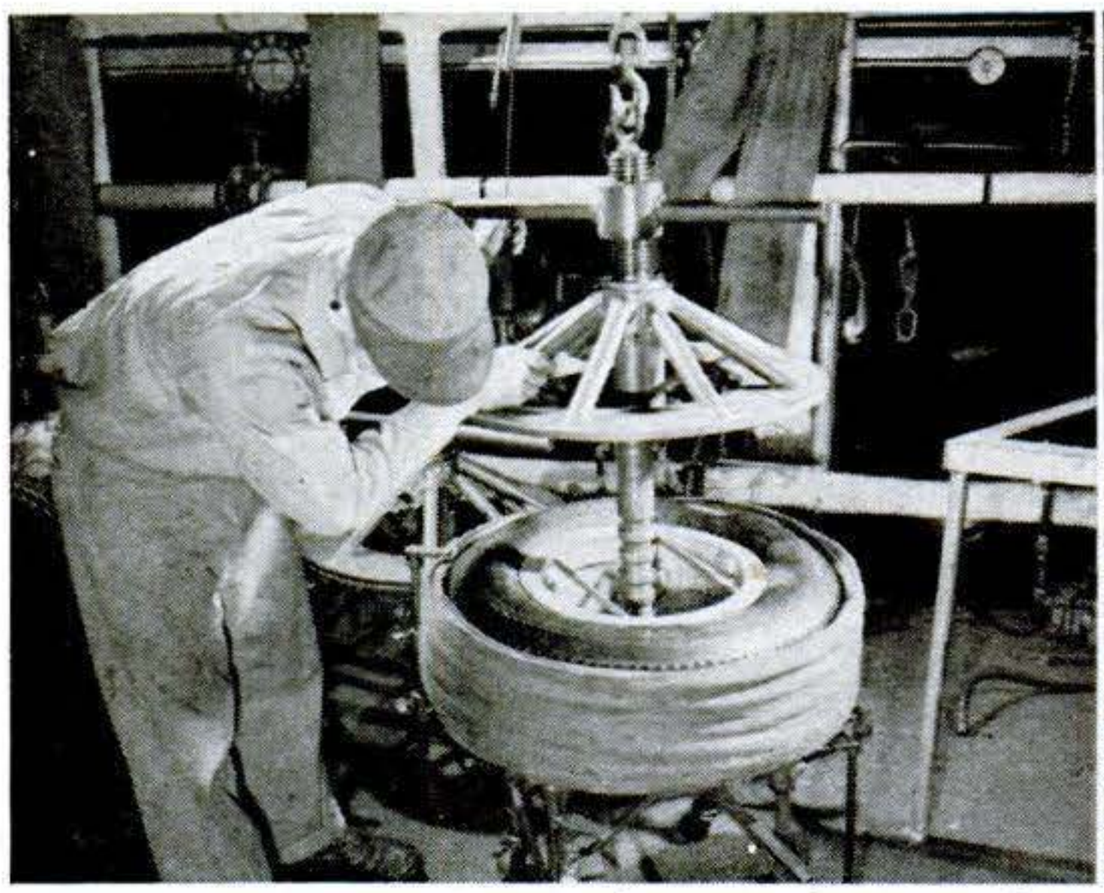
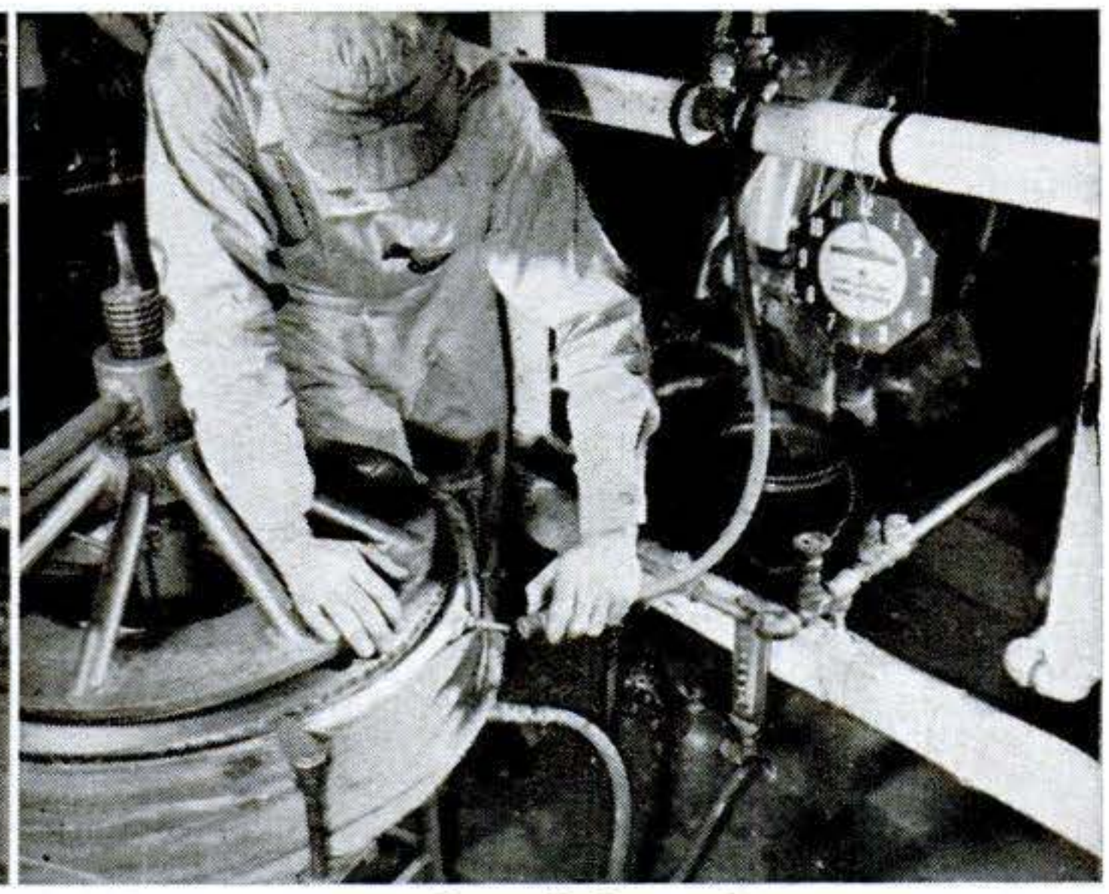
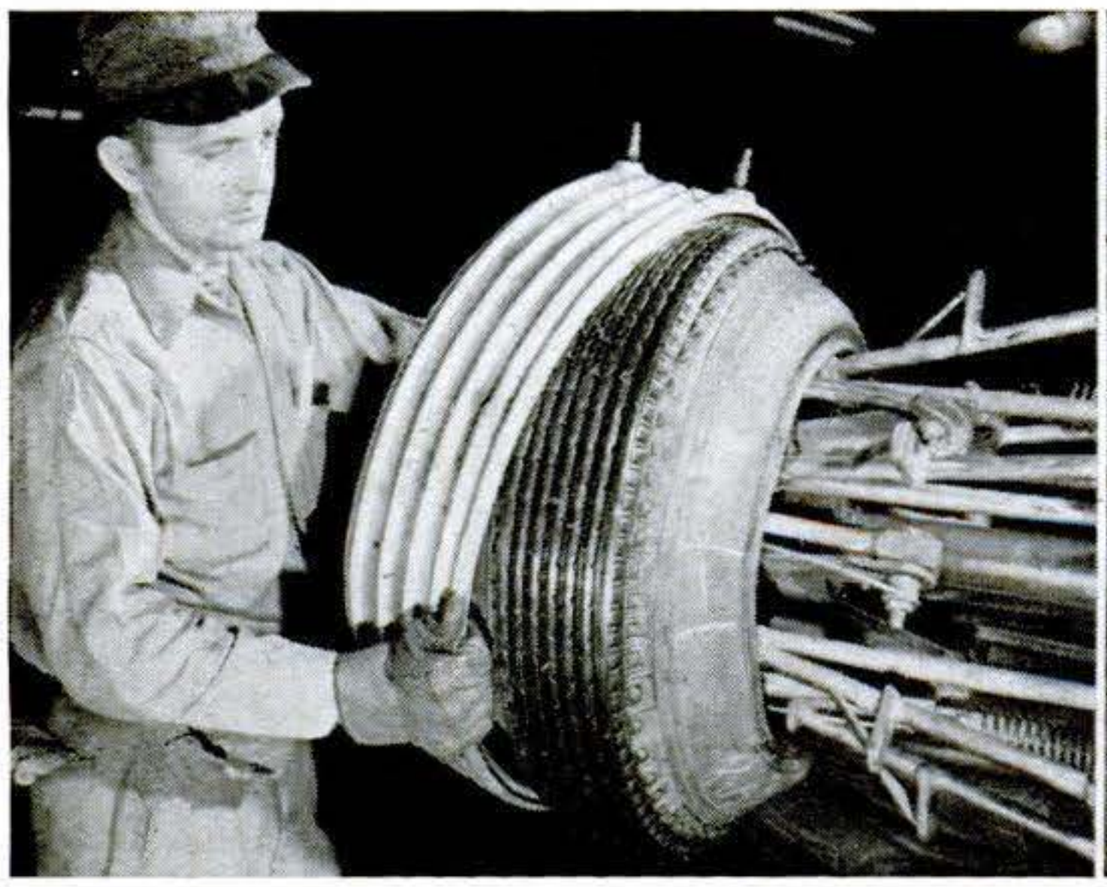


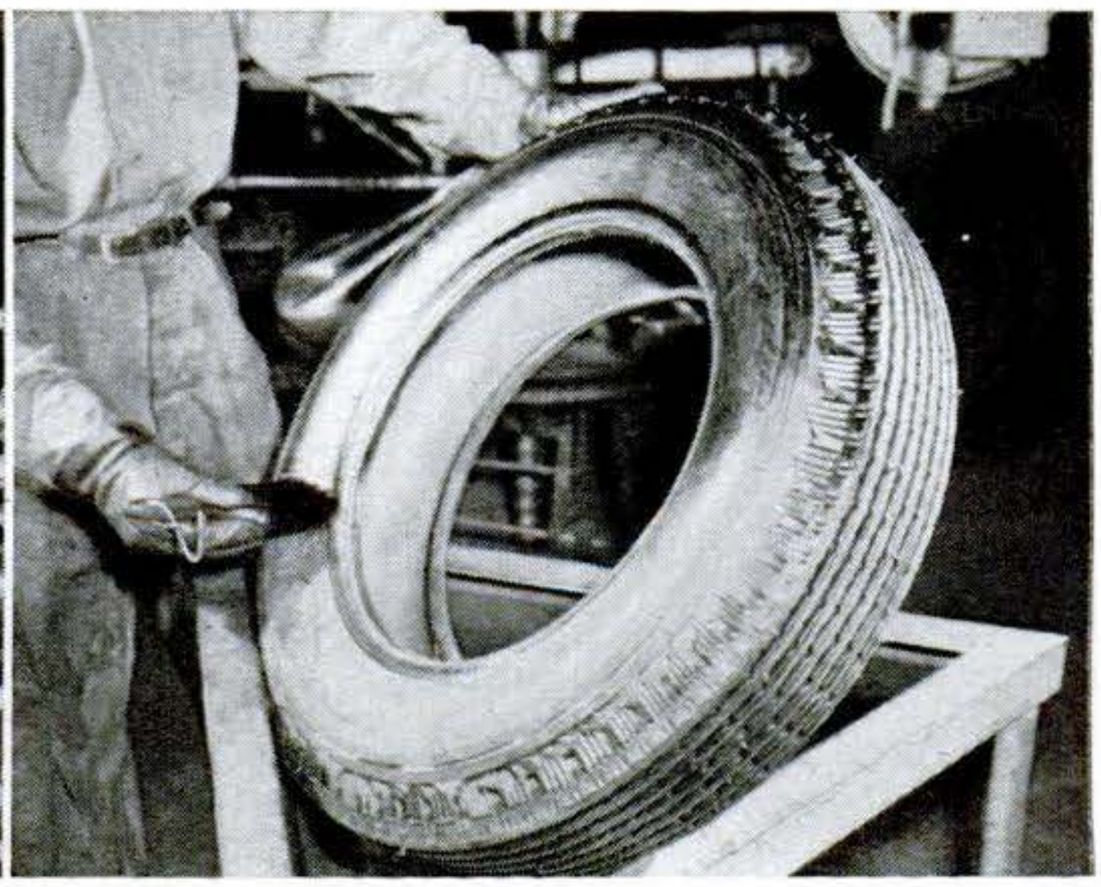
5. Interlocking rims inside casing's inner diameter and clamps on the sides withstand pressures built up during curing. Inner tube is inflated to pressure of 90 pounds or more.



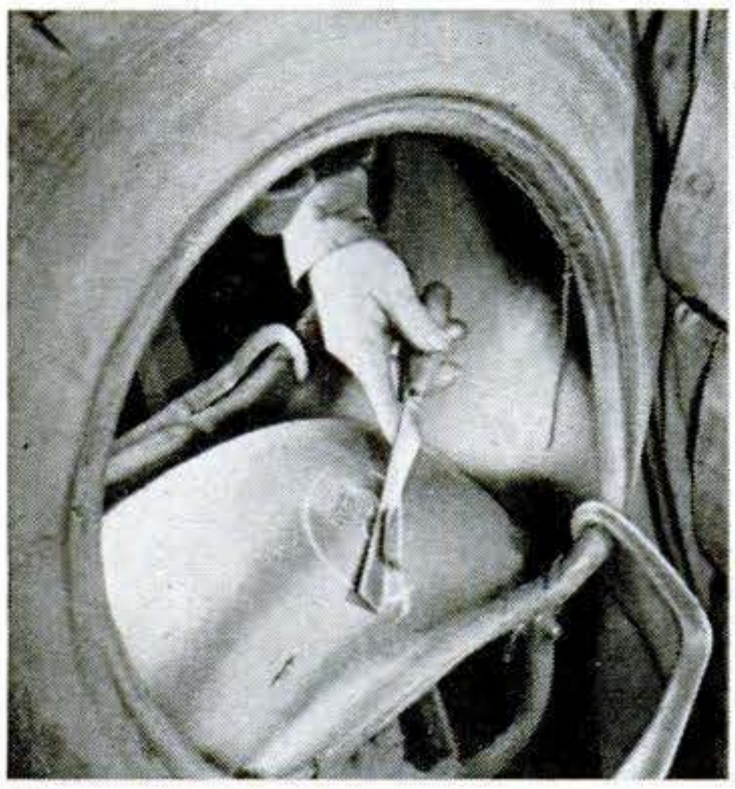
6. Dry steam is forced through curing ring under 52-lb. pressure at about 290° F. Curing takes 1½ to 3½ hours, depending on tire size. Removal time is set on cardboard clock face.



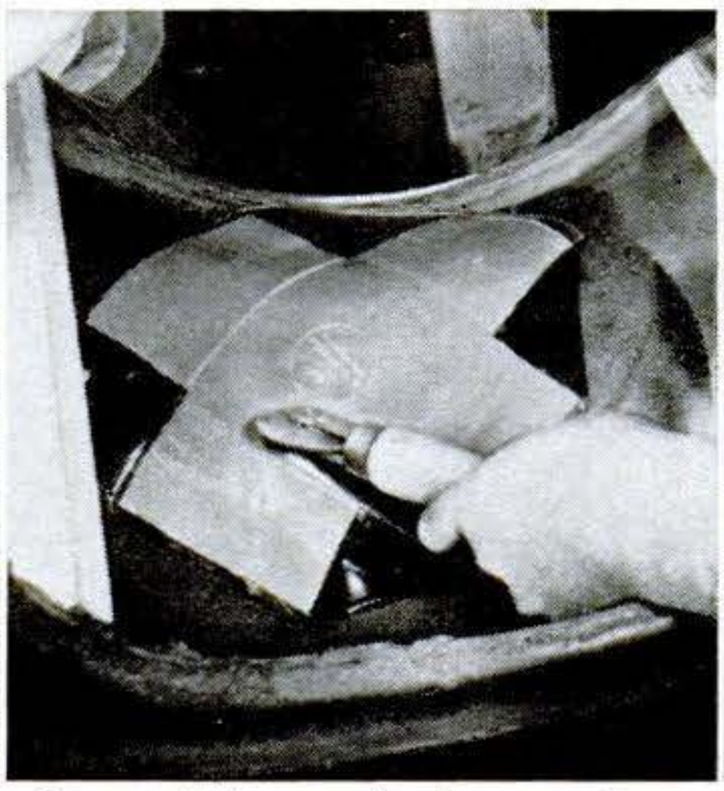
7. New tread shows up as curing band is pulled off. Ring is smaller than tire to increase curing pressure, so tire must be spread to reduce diameter when ring is put on and removed.



8. Sidewalls are painted to improve appearance of tire before delivery to customer. Excess rubber at sides is trimmed away, buttons on tread are left. These wear off in a few miles.



Spot repair sometimes precedes recapping. Inspector marks spot and workman skives injury at an angle inside and out. Then he buffs it, applies cement, and lets it dry.



A patch is worked into place inside casing with a stitcher after hole has been filled with cushion gum. Tread gum is worked into hole from outside and then trimmed down flush.

A sectional mold cures the repair. One shown consists of metal steam core inside casing, rubber steam bag outside, and saddle around assembly to hold it together.

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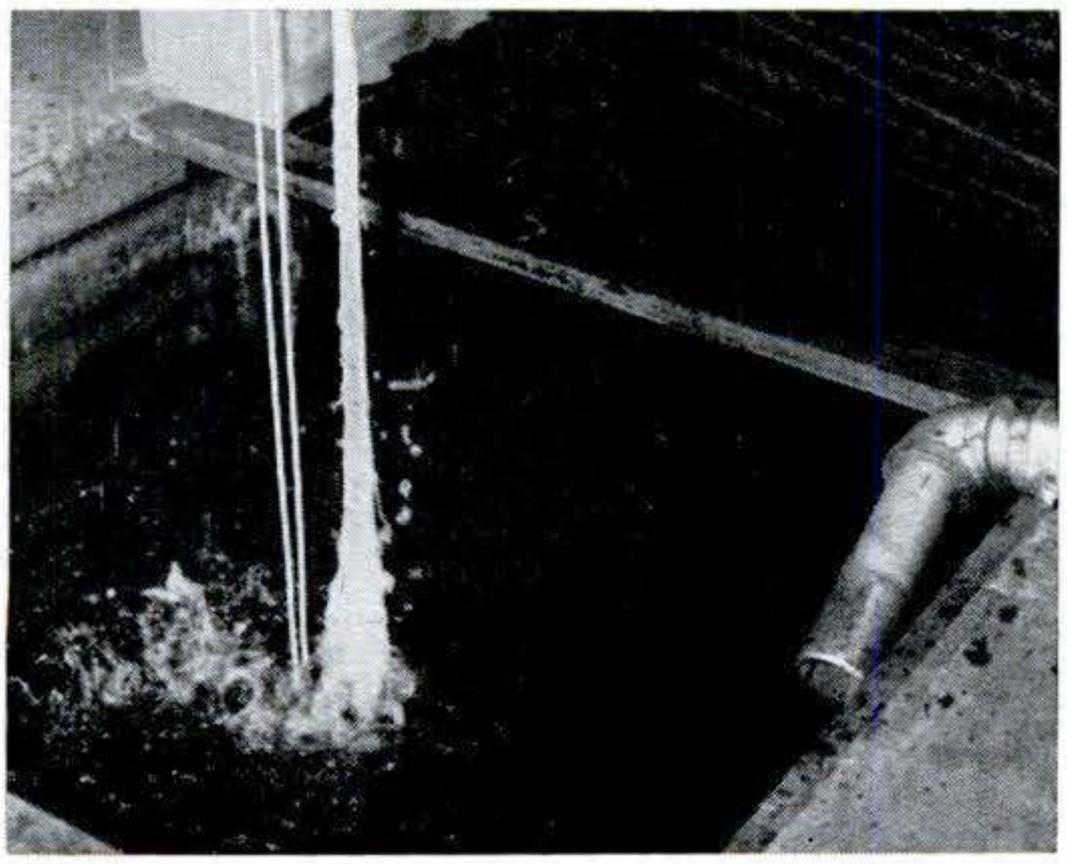
Clothesline, a motor, and pulleys make this pump, which raises 12 gallons a minute 25 feet.

Rope Lifts Water—Without a Bucket

NOW you can pump water with clothesline—no pipes, no valves, no buckets—just ordinary rope clothesline sent spinning around pulleys by a motor. Two University of Illinois professors are already doing it, raising 12 gallons a minute about 25 feet. It's not a trick. They foresee many uses for such a cheap, easy-to-rig pump.

The clothesline just races down and up through the water at 40 feet per second—the speed imparted by a 6-inch pulley at 1,750 r.p.m. As the rope comes up, friction makes a quarter-inch layer of water stick to it. The water is thrown off into a chute by centrifugal force when the rope speeds over the top pulley.



Thick layer of water sticks to upbound (right-hand) clothesline. This model uses double ropes, handles twice as much water as single line. Lower pulley is weighted to prevent tangles.

The reason it works is the same reason you'd have trouble running down an *up* Escalator. The water is always pouring down the upbound rope, but so long as the rope moves up faster than the water moves down, the rope wins and water is pumped.

Actually, rope pumps are centuries old. Professors Henry L. Langhaar and William M. Owen ran across mention of one in an old book on hydraulics. The author didn't think much of the idea, and neither did the professors. But they tried it—at a total expenditure of 98 cents for 100 feet of clothesline. The ¼-hp. motor and pulleys were found in the laboratory.

To their surprise, it worked amazingly well. Some water drips back through the rope holes, but this is a minor loss. Since there seems to be no limit on the height of lift, they think it could do almost any job, such as raising water for livestock.

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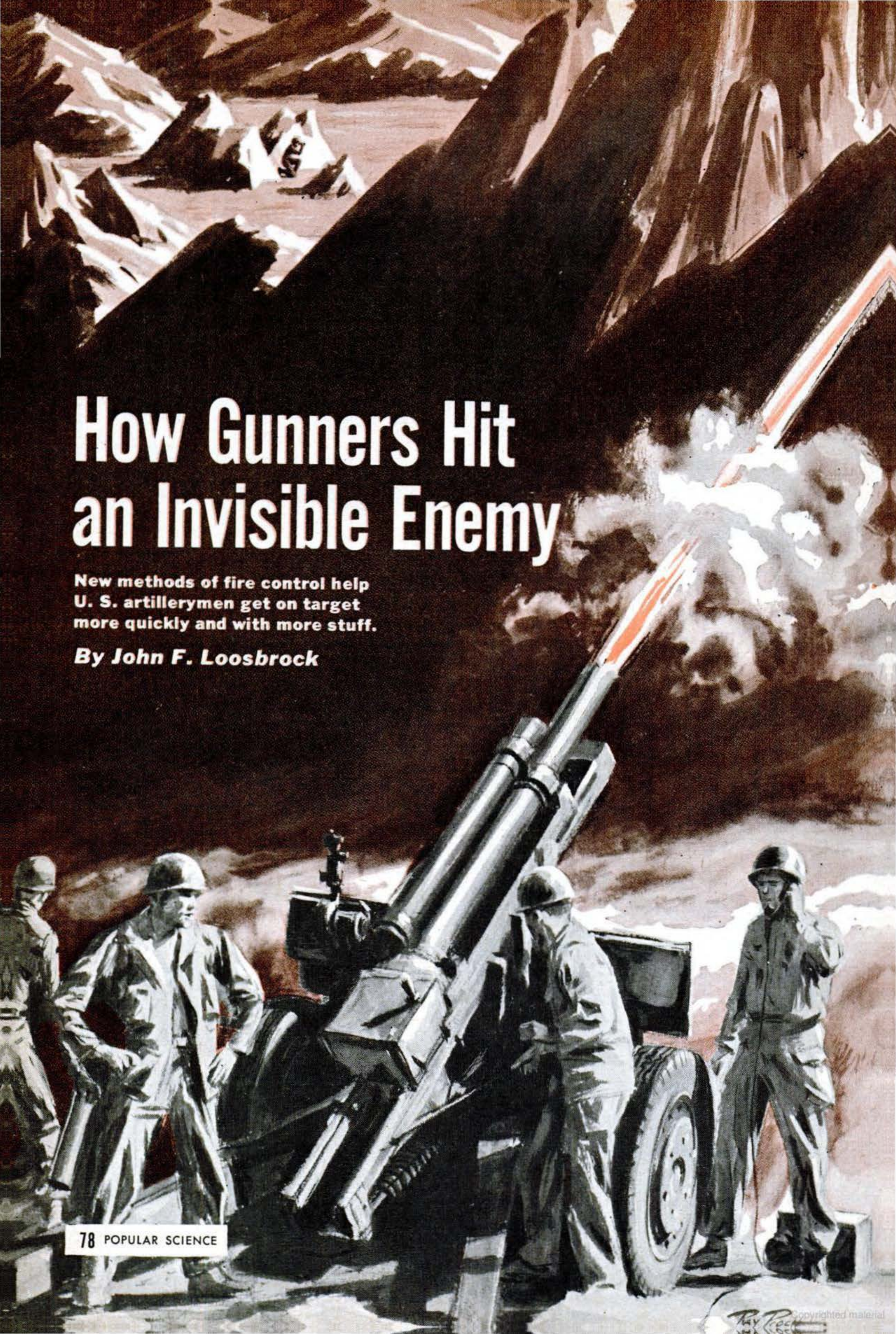

How Gunners Hit an Invisible Enemy

New methods of fire control help U. S. artillerymen get on target more quickly and with more stuff.

By John F. Loosbrock

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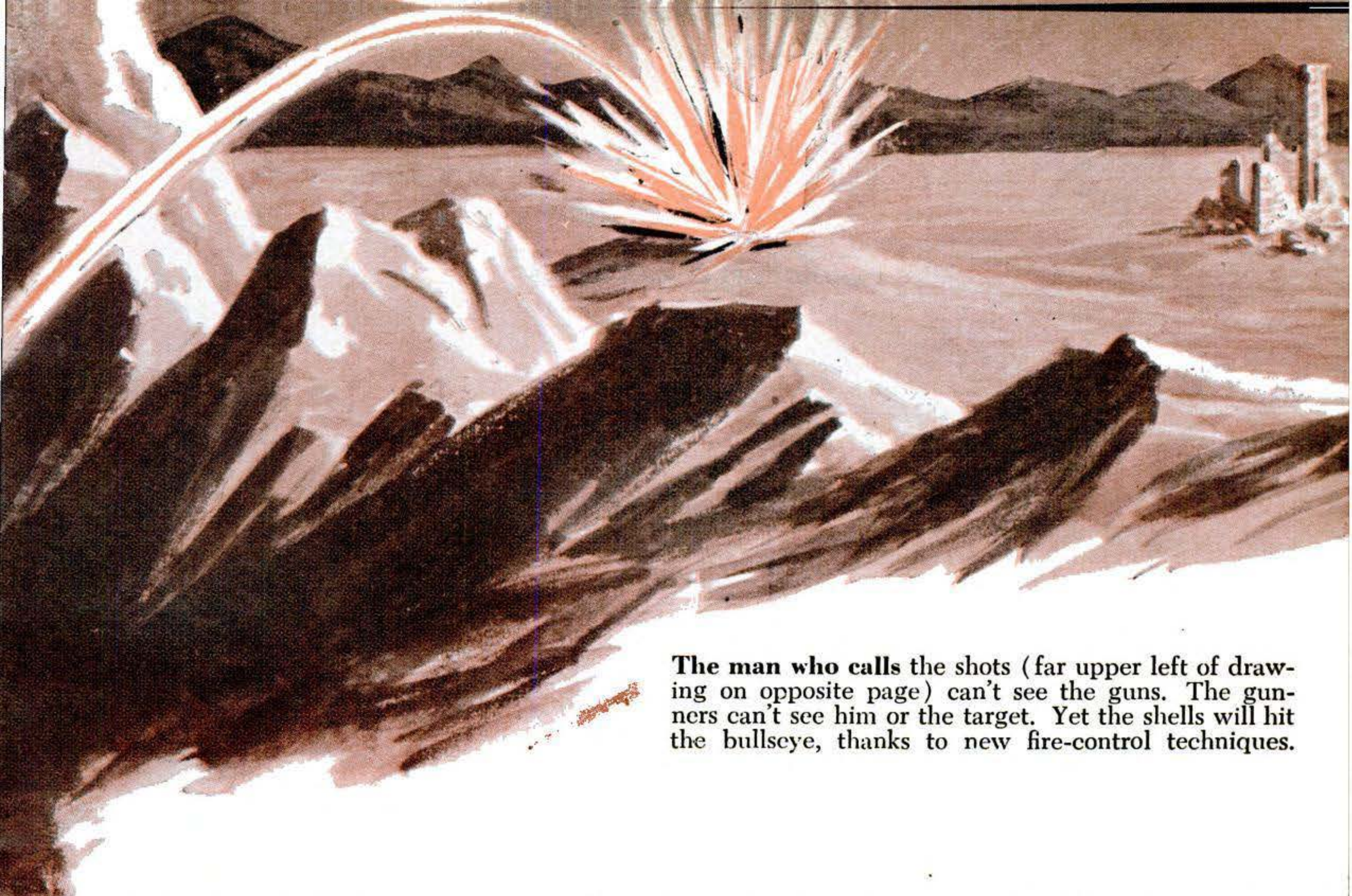

The man who calls the shots (far upper left of drawing on opposite page) can't see the guns. The gunners can't see him or the target. Yet the shells will hit the bullseye, thanks to new fire-control techniques.

"YOU can't hit 'em when you can't see 'em" is an old baseball saying. But any field artilleryman can tell you it ain't necessarily so. On the battlefield you *have* to hit targets you can't see. Often from up to 20 miles away. Now you can do it quicker and with more stuff than ever before, thanks to new and simpler fire-control methods developed since World War II.

Lobbing a 200-lb. chunk of TNT and steel on a target 20 miles away is a game of ballistic hide-and-seek. Somebody that can see the target calls the signals. He's your forward observer—FO for short. He's usually an artilleryman, although in a pinch a doughfoot can take over.

When you're an FO you're the eyes of your cannoneer. First you tell him about where the target is. Then you watch his shots, telling him whether they're over or short, to the left or right. He changes his aim until he's dropping them on the target. Then he, and the other five guns of the battery, "fire for effect."

You can adjust fire from a ground observation post (OP) or from a spotter plane. In any case, you must be able to talk back and forth with your guns, usually by radio.

World War II fire control was good, but it had its drawbacks. The observer had to be a combination artilleryman, infantryman, and electronic brain. He had to know exactly where he was, where his guns were, and where the target was—on a map, aerial photo, or firing chart. And he had to do a lot of figuring to get fire on the target.

Now the high-order computing is done back in a fire direction center (FDC). All you need is to spot some check point the battery knows about, be able to read the compass direction (called azimuth) from you to the target, and be able to estimate distances roughly.

Take a typical example. You're an FO attached to the infantry battalion your battery is supporting. You haven't seen your outfit for days. Since your last trip back the guns have moved. You don't know exactly where they are. They don't know where you are. You've lost your map. There are no aerial photos. You don't even have a firing chart, which is a simple grid arrangement drawn to scale on plain paper. Some dug-in machine guns are giving the doughfeet trouble, and they want artillery fire quick.

So you look for a check point that's not too far from the target. Often it's a target your guns have already fired on. Or maybe it's something, like a big rock formation, that your gunners have already zeroed in on and plotted on their charts. That's standard artillery practice. The more check points, the easier it is to hit a new target.

Take out your compass. Read the azi-

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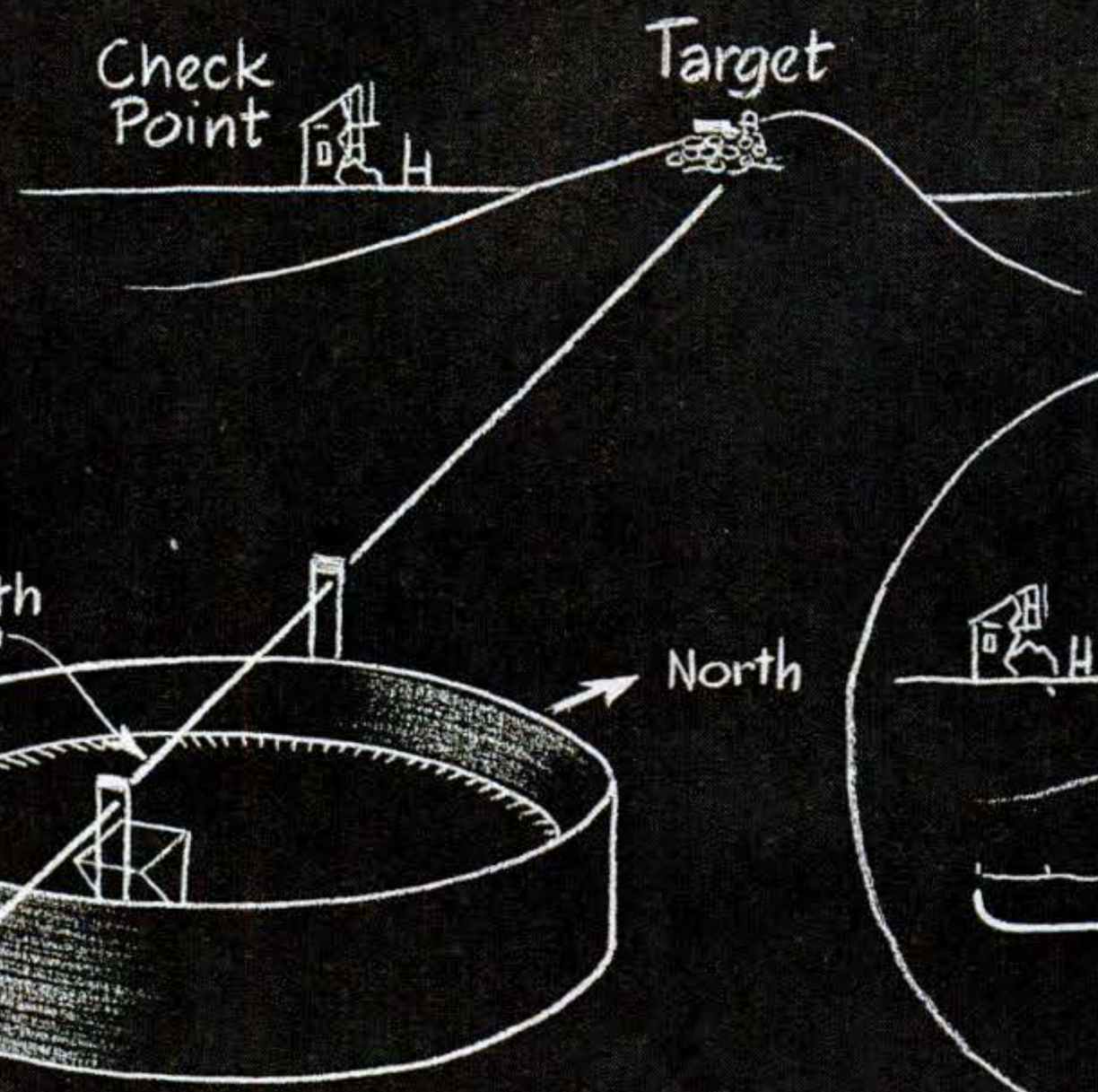
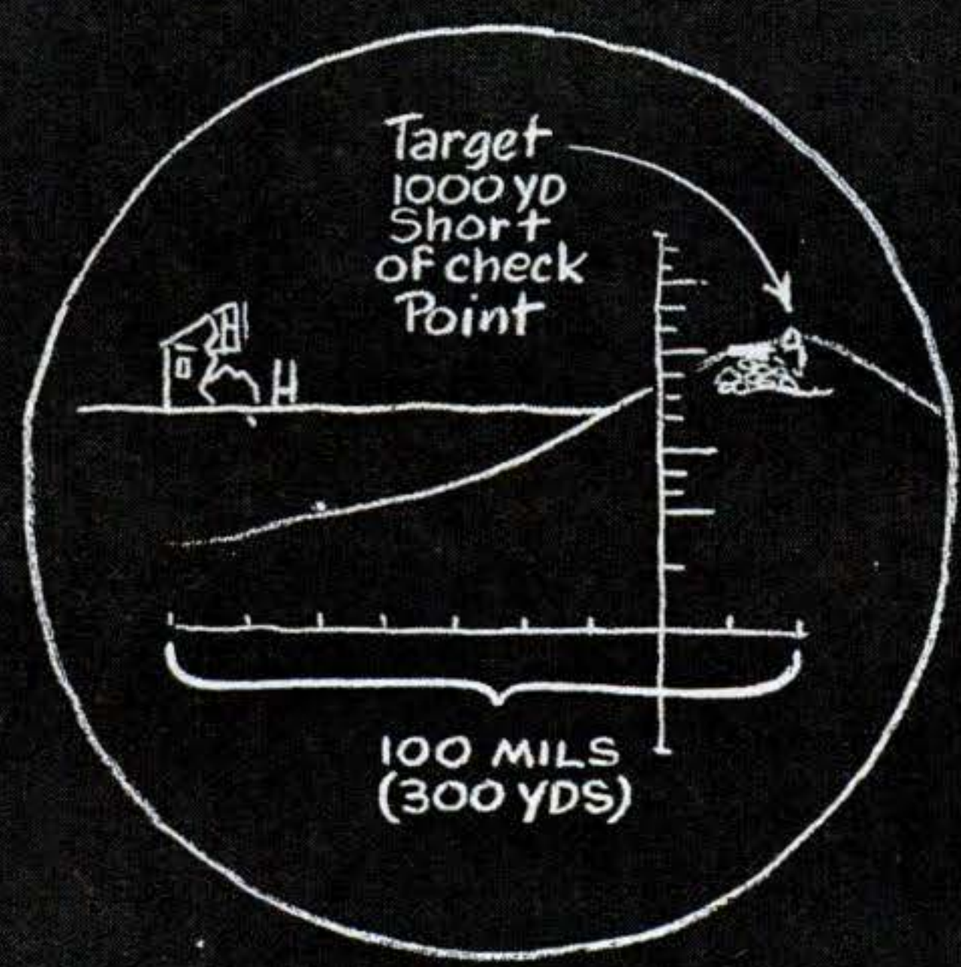
1 FORWARD OBSERVER (FO)



Good observation is key to accurate artillery fire. Here an enemy machine gun is slowing up advance of our infantry. They tell forward observer they want it knocked out. FO's job is to relay information to guns. First step is to establisn observer-target line. FO uses compass to measure azimuth (direction) to the target. It's 4,350. (Compass prism reads off side nearest user.) He then locates nearest check point, location of which is known to fire direction center.



FO's next job is to locate target in relation to check point. Aided by scale etched on field-glasses' lens, he estimates target is 1,000 yards short, 100 mils right of check point. To convert mils to yards, FO uses mil-relation formula—one mil being one yard wide at range of 1,000 yards. He estimates range to target as 3,000 yards, multiplies 100 by 3 to get 300 yards deflection.

muth to the target from you. (In the artillery, azimuth is direction expressed by slicing a circle into 6,400 segments, like cutting a pie. The segments are numbered counterclockwise from north.) Your compass says the target azimuth is 4,350. That locates it in direction, from you.

Mils Help You Report Deflection

Now look at the machine guns through your field glasses. A scale of "mils" etched on the lens helps you. Like azimuth, the mil is based on the division of a circle into 6,400 pielike segments, each called a mil. Those machine guns seem to be about 100 mils to the right of the check point and about 1,000 yards short of it.

Here's where something called the mil-relation formula comes in. It helps you measure lateral distance, or deflection. The formula considers one mil to be a yard wide at a distance of 1,000 yards from you, two yards at 2,000, and so forth.

So you estimate by eye the distance to the target. It's about 3,000 yards. Multiplying 100 times three gives you 300 yards. So the target appears to you as 1,000 yards short of the check point and about 300 yards to the right of it.

But it isn't located that way in relation to the guns. (Unless, of course, you happen to be exactly on the gun-target line.) Using the old system you'd have to allow for these discrepancies before radioing a fire order. To find out where your guns were you might have to ask for a "ladder," or series of rounds, each with a slight increase in range. Bursts would give you the gun-target line.

But with the Army's new "target-grid" system the fire direction center takes over.

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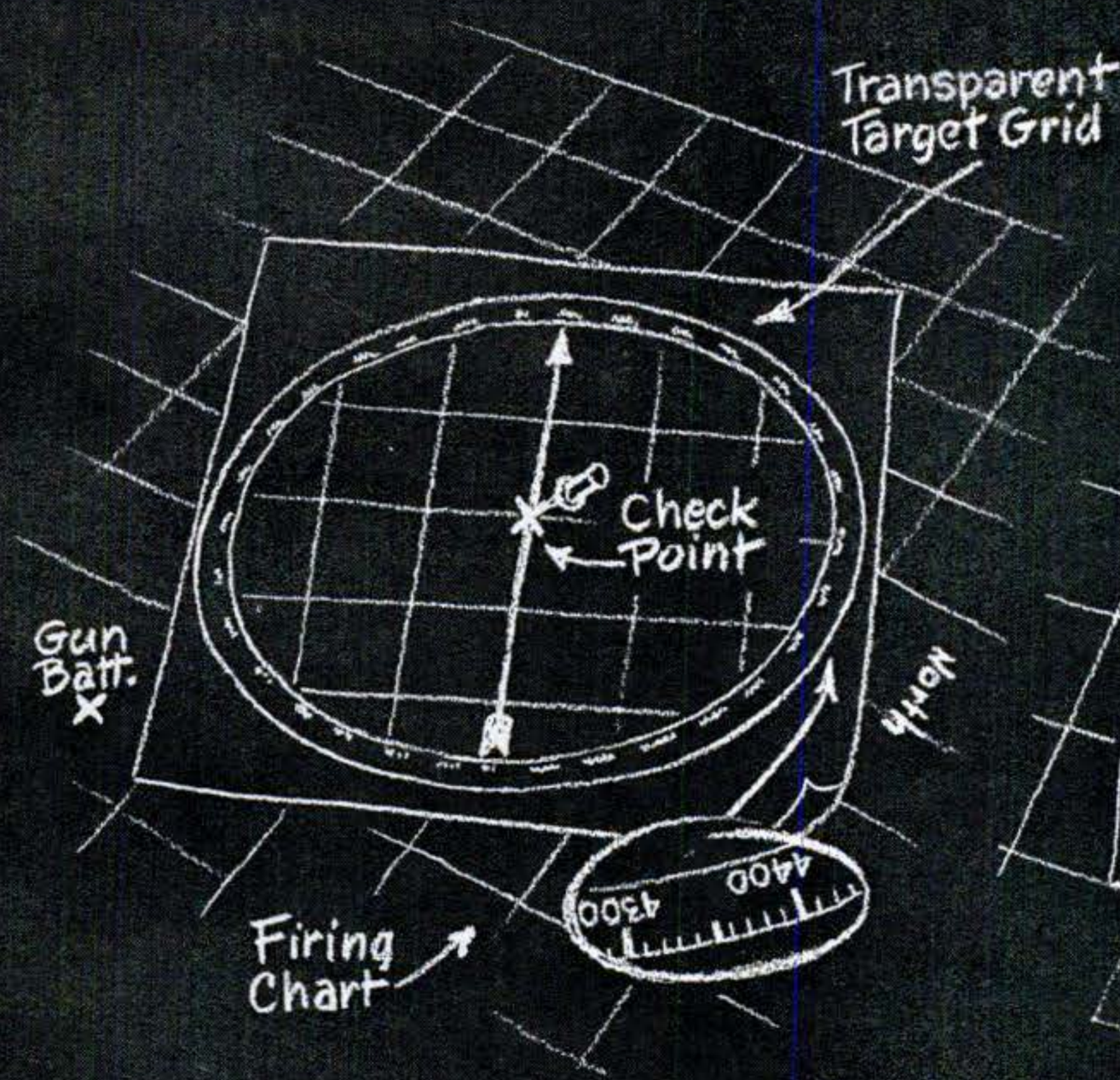
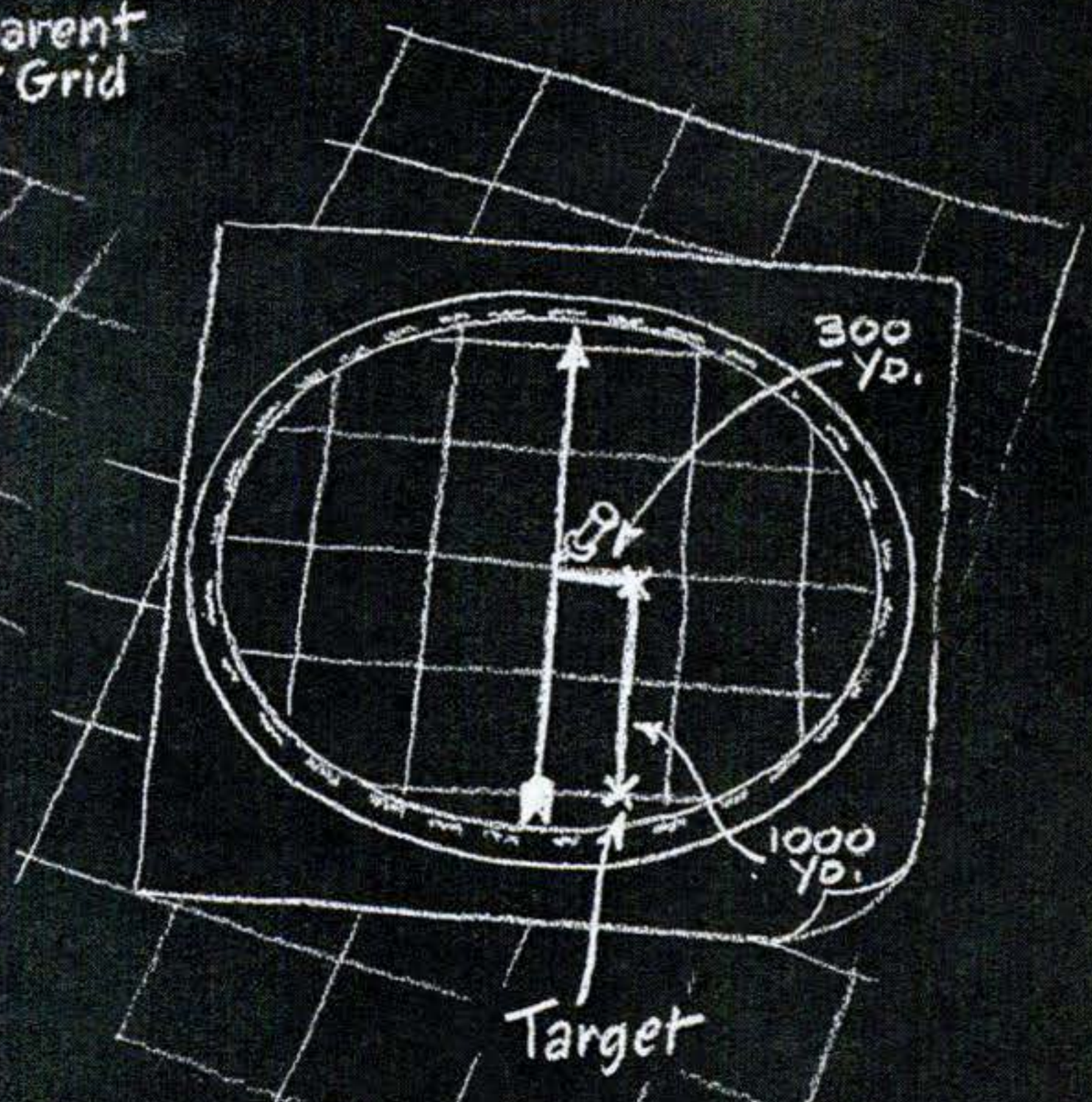
2 FIRE DIRECTION CENTER (FDC)



Using Army's new target-grid system, fire direction center converts information from observer into fire commands for guns. Target-grid is transparent circular graph with circumference graduated in azimuth. Arrow with tip at north bisects grid. With it FDC can spot target even if it doesn't know for sure where FO is, and when location of guns is unknown to FO.



Grid is pin-pointed over check point, the place for which gun settings are known. Then it is turned until azimuth from FO to target coincides with north on battery firing chart. FDC then knows that observer-to-target line is parallel to arrow on grid. Working from the check point, FDC next determines gun settings that should drop a registering shell on the target.

It does the figuring for you. You give it the azimuth, locate the target in relation to the check point, and specify the ammo.

The FDC works with a "target grid," a transparent, circular graph with azimuth divisions on its circumference. A side of each square on the grid represents 100 yards on the ground. An arrow bisects the circle, its point on azimuth zero, or north.

A soldier in the FDC puts this grid over the battery's firing chart so that its center falls on the mark representing the check point. He rotates the grid until the azimuth number of the target reported by you—the field observer—coincides with north on the chart. This establishes a vital parallelism: it means that the line of the arrow on the grid is now parallel to the line between you and target. It gives a reference by which FDC can aim the guns and begin firing.

What happens? In this case you as FO are on the flank of the gun-target line. So shells that look as if they're falling to the right would actually be beyond it.

Call 'Em as You See 'Em

But the FDC worries about that. The grid on the chart lets you call 'em as you see 'em. And when you hear that first "On the way" from your battery, you watch for the tell-tale puff of dirty gray smoke. You call back, "Right 80, drop 100."

This time the burst is okay for direction —from your viewpoint, remember. But it's about 75 yards short. That means you have a bracket—an over and a short. That's what you want. Your bracket is under 100 yards so you split it, "Add 50. Fire for effect."

While the registering gun has been firing, the other guns in the battery have been cor-

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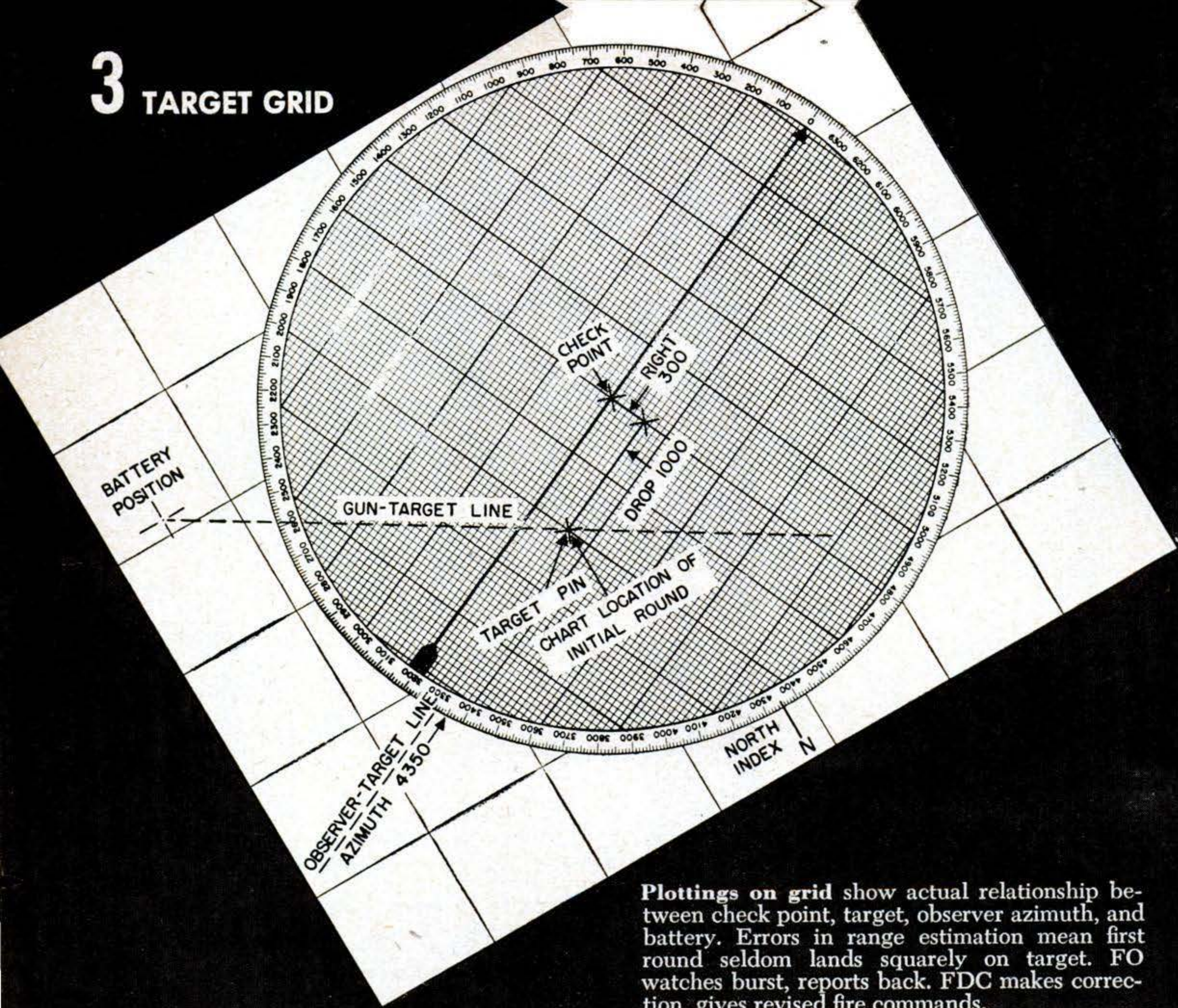

Plottings on grid show actual relationship between check point, target, observer azimuth, and battery. Errors in range estimation mean first round seldom lands squarely on target. FO watches burst, reports back. FDC makes correction, gives revised fire commands.

recting their aim. So at "Fire for effect" the whole battery calls "On the way." The natural dispersion of the shells in this narrow bracket blankets the target.

The target-grid system helps the artillery get on target quicker. That's because the complicated figuring is done in the comparative peace and quiet of a rear-area FDC. And the new method is easier to teach. So if an FO is knocked off, as he frequently is, a doughfoot with only a rudimentary knowledge of artillery can carry on.

Quick Fire Adjustment Pays Off

This business of getting on target quickly is largely the difference between good and poor artillery fire. If you fumble around, dropping round after round all around the target, it doesn't take the enemy long to wise up. He digs in or scurries for cover. When you finally get around to calling for "Fire for effect," your target has gone.

Quick fire adjustment pays off in still another way—the war-proven technique of massing the fire of many guns on a single target. Called TOT, for "time on target," it calls for top-notch electronic communication and split-second timing. Here's how it works:

You adjust with one gun, just as you would for an ordinary shoot. But your corrections are relayed to the guns of perhaps dozens of battalions. They make their aiming corrections according to your adjustment. At "Fire for effect," hundreds of guns along a whole corps or army front rain down fire on the same target.

The surprise and shock effect is terrific. But a TOT shoot is complicated. You have to calculate and allow for a great number of factors. Guns are at varying distances from the target and shells have different times of flight, depending on weight and muzzle ve-

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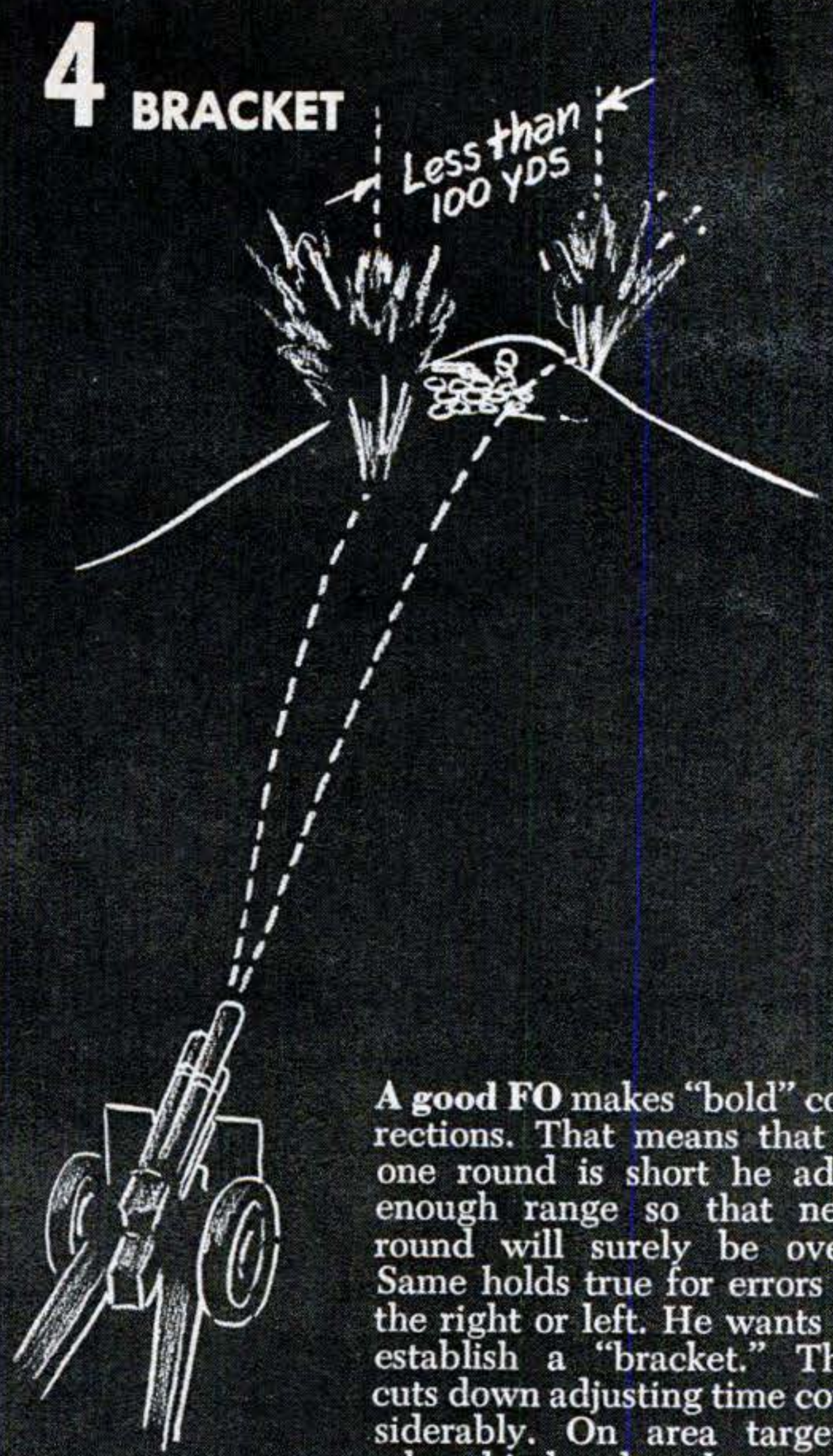
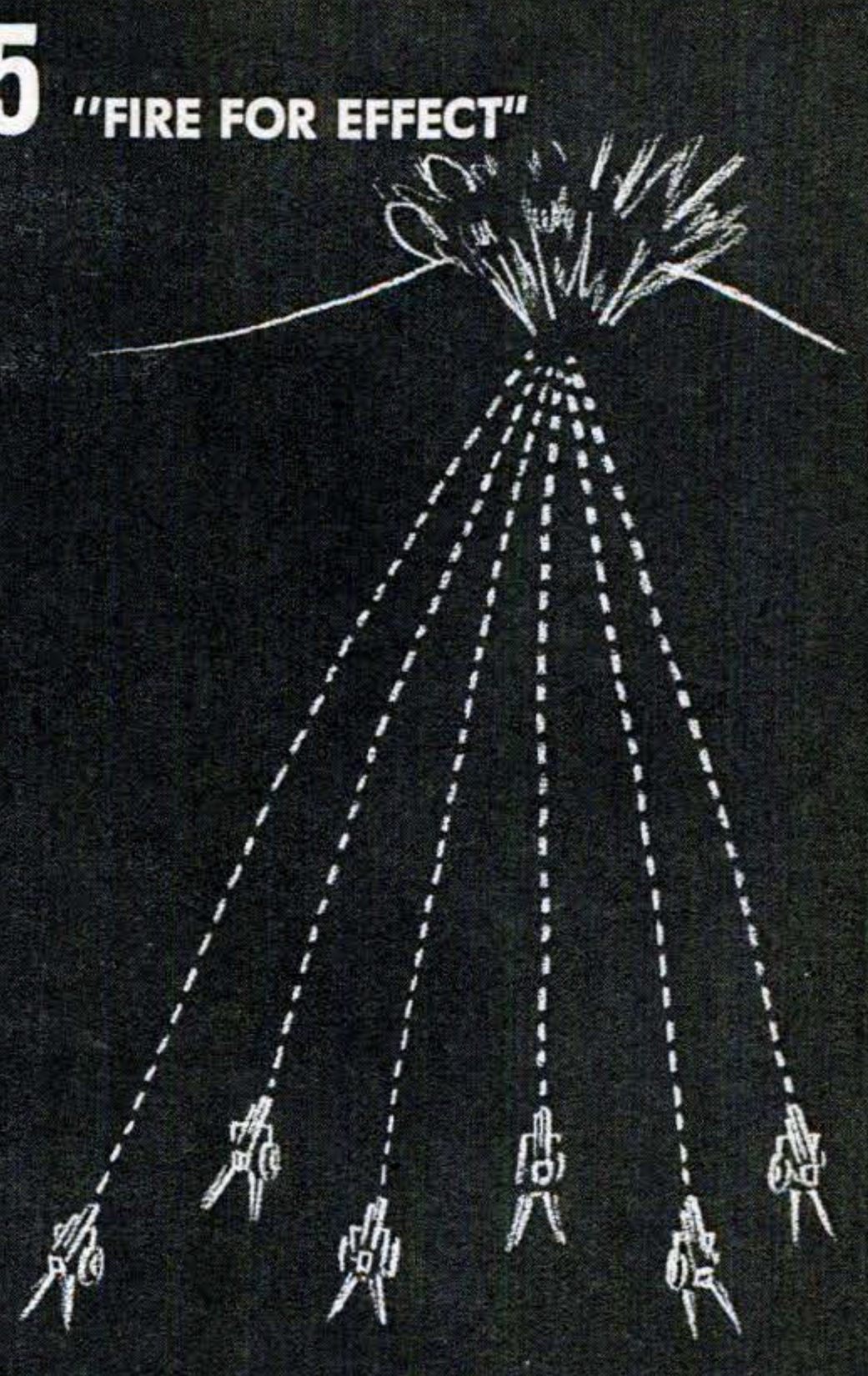


A good FO makes "bold" corrections. That means that if one round is short he adds enough range so that next round will surely be over. Same holds true for errors to the right or left. He wants to establish a "bracket." This cuts down adjusting time considerably. On area targets, when his brackets have narrowed to 100 yards or less he splits them and asks for "Fire for effect." Pin-point targets call for finer adjustment of fire.



Thus far all firing has been done by one gun. But while it has been firing, other five guns in battery have been making necessary corrections in their aiming data. So when FO splits his final bracket and calls for "Fire for effect" all six guns go into action. Dispersion, due to many small variations in shells and guns, blankets the target. "Cease firing, end of mission."

locity. So the 240-mm. howitzers, 20 miles away, begin firing long before the 105s, only five or six miles away, join in. Tons of TNT hit the target simultaneously in one tremendous bang. And the doughfeet love it, for then they can move in standing up.

Even the Earth's Rotation

This isn't the whole story of good artillery shooting, of course. There are literally dozens of variables that have to be considered and compensated for. You have to allow for the drift that results from the rotation imparted by the rifled barrel. There are variations in powder temperature, air density, and air temperature to be considered. Wind affects accuracy. You even have to allow for the effect of the earth's rotation.

Predetermined firing tables for each type of ammunition, based on ideal conditions, help you in your calculations. Every so often you'll get a "metro message" or "mif-mif." It gives you the latest meteorological dope for the area. And you must calibrate your guns, to allow for their individual eccentricities that result from minute imperfections of manufacture or wear.

Often you may have to fire without adjusting, if the target is fleeting, like enemy vehicles that would take off after the first round. In that case you get your data from map coordinates and cross your fingers. You may get long-range counterbattery missions —firing at enemy artillery. Or you may be given an interdictory mission—sporadic firing to deny the enemy use of a place.

But it is the precise, adjusted fire that really pays off, and here is where American artillery has always excelled. That's why the new firing techniques are important. And that's why "On the way" is sweeter music to the infantry than ever. END

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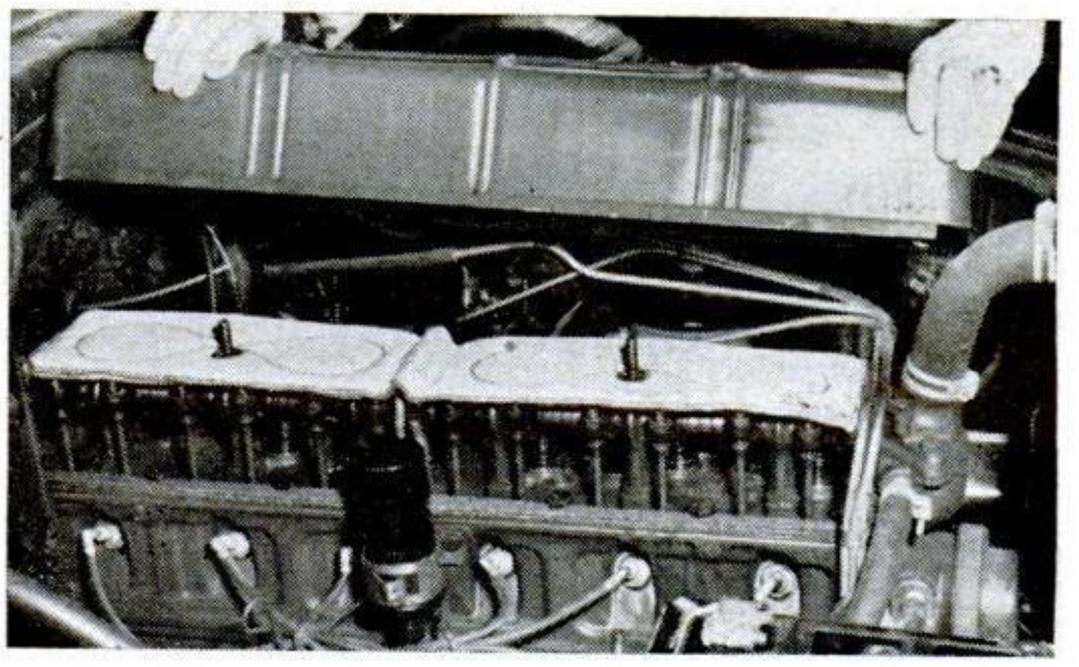
London Airport Ready for Crash Fires

NEWEST British equipment for fighting aircraft fires is the mobile unit above, stationed at London Airport, that carries a supply of 6,000 pounds of liquid carbon dioxide and 300 gallons of foam solution. It is sprayed from two movable-boom nozzles and two hand nozzles (left). Man at far right holds a tool for ripping open a fuselage.

Pads Silence Overhead Valves

A NEW product has been developed to deaden the clicking in the rocker arms of overhead-valve engines. Called Val-Vin-Hed Silencer, it consists of cotton wicks sewed together, enclosed in a porous cover, and soaked in motor oil. Laid on top of the rocker arms, the pad is said to give additional overhead lubrication. The Joe L. Estes Co., of Winder, Ga., makes the silencer for Chevrolets, Buicks, and GMC trucks.



What Have These Planes in Common?

ANSWER: both have pusher-type propellers and both can fly. (Yes, the tiny 1912 biplane, seen in center foreground back of giant B-36 bomber's wing, is still flying.) But there similarity ends. Power: 42,000 hp. to 80 hp.; engines: six piston, four jets to one rotary; wingspan: 230 feet to 32 feet; weight: 385,000 pounds to 1,150 pounds; speed: 435-plus m.p.h. to 70 m.p.h.; size: well, take another good look.

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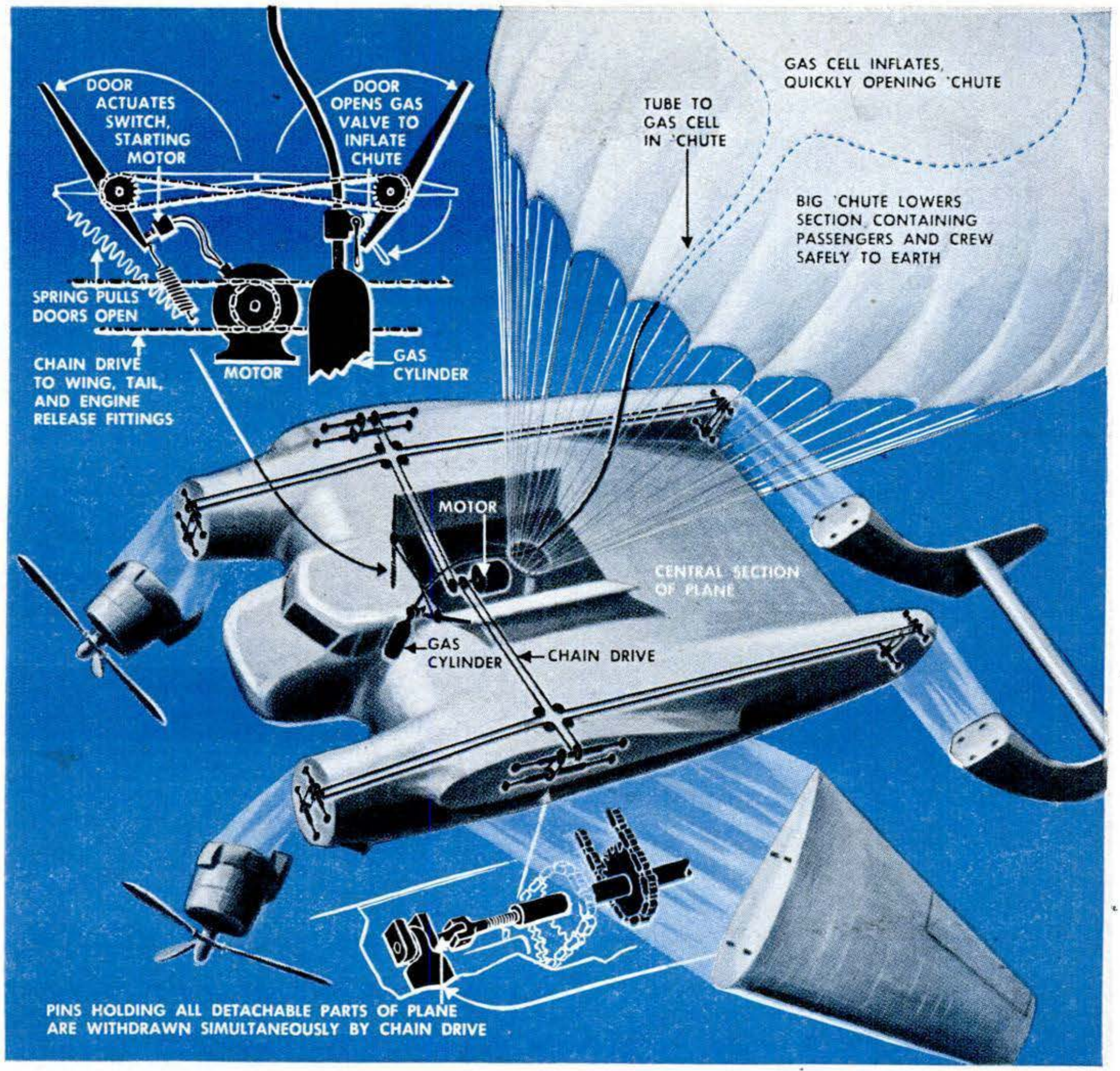

Parachute to Land Come-Apart Plane

IF ENGINE failure or other reasons compel a dangerous emergency landing, the pilot of this proposed air liner pulls an emergency lever—and the plane falls into six pieces! Wings, tail section, and engines drop away as pictured above. Thus stripped of excess weight, the fuselage section containing passengers and crew floats gently and safely down at the end of a giant parachute.

Two New York inventors, D. Manfredi and A. Raiti, envision this come-apart plane as the solution to important problems of air safety. Their idea has been endorsed as practical by Vincent J. Burnelli, flying-wing plane builder, who has assisted them in working out details of design.

Key feature of their plan is a large and quick-opening parachute, carried in an amidships compartment with exterior doors. It contains a gas cell connected by tubing to a cylinder of compressed gas.

The pilot's emergency lever unlatches the spring-operated doors of the parachute compartment and they fly open, actuating the rest of the mechanism as they do so. One door opens a gas valve that inflates the gas cell of the parachute, ejecting and spreading the 'chute almost instantaneously. Meanwhile, a motor, started by the opening of the other door, operates a chain drive to worm-and-pinion fittings. These simultaneously withdraw pins joining the cabin to wings, tail, and engines, and these appendages fall off. Besides lightening the cabin, this sheds the fuel tanks in the wings and reduces the risk of fire in a crash. At sea, the watertight fuselage section will float while occupants await rescue. END

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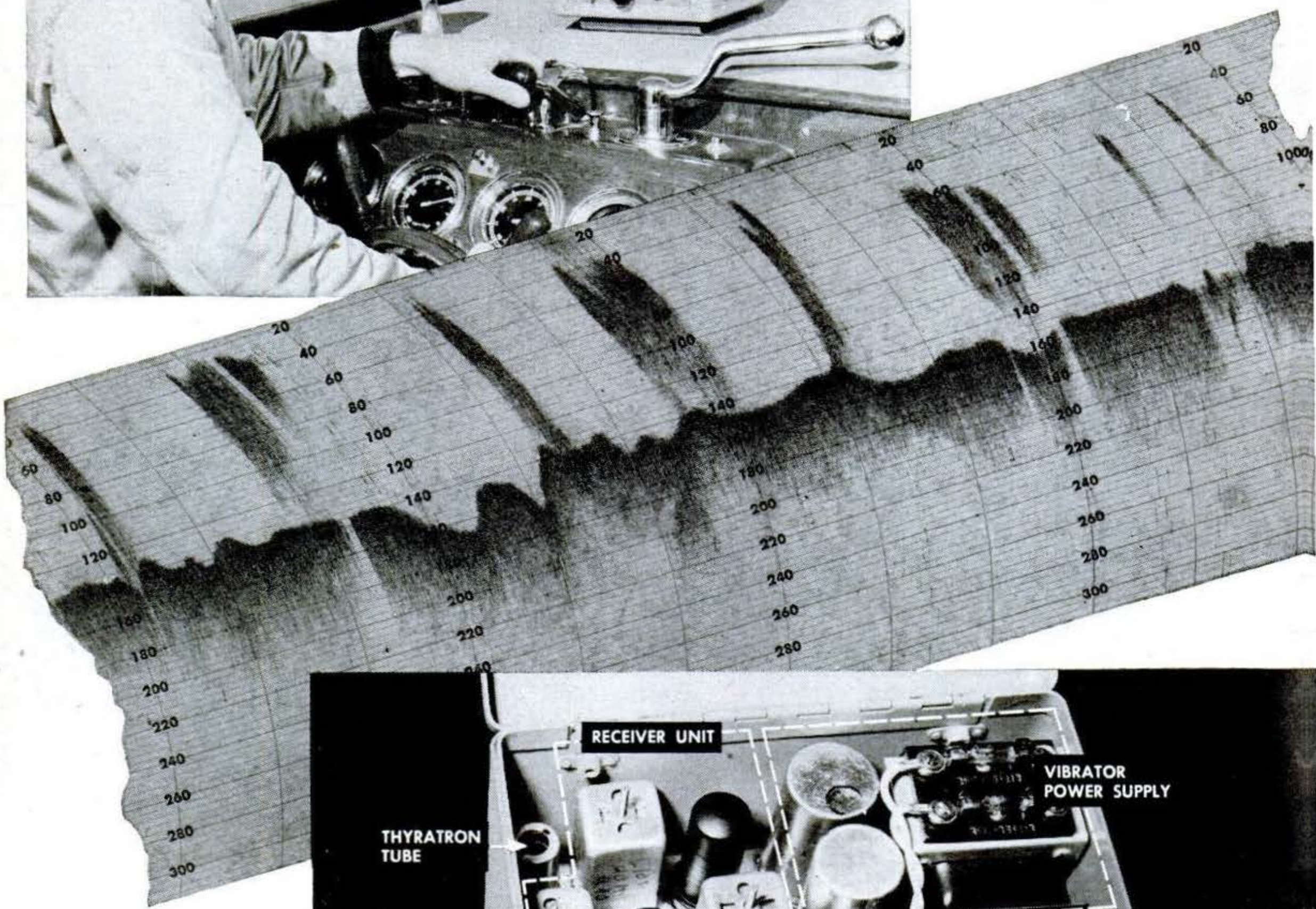
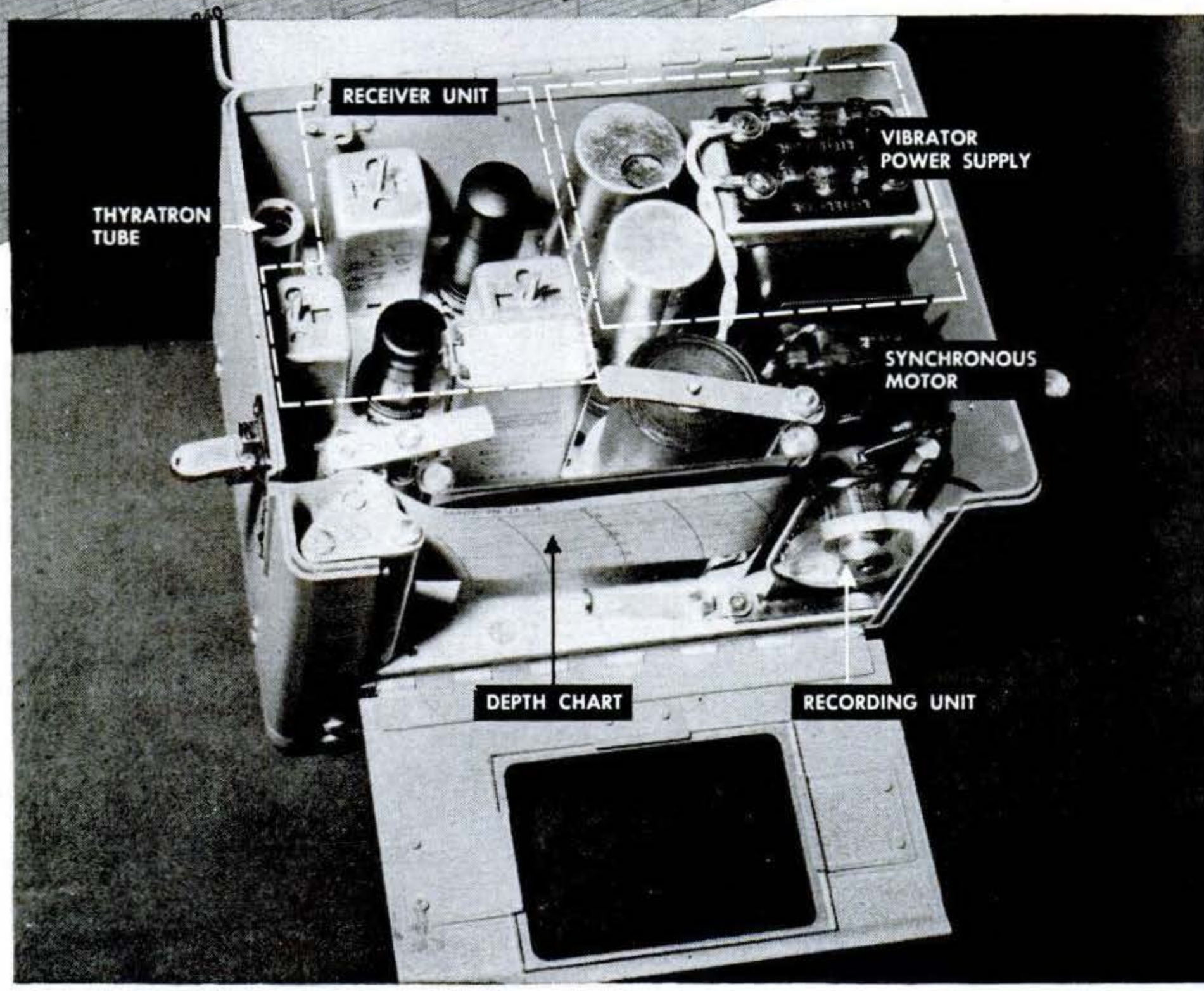
Installed on sports boat, depth recorder looks like portable radio with postcard-size TV screen. Unit, in splashproof metal case, weighs 14 lb. Outfit costs $450.



Depths of fish "sighted" during 24 minutes off Pacific Coast are shown in feet on chart drawn by recorder. The dark spots are single fish above big school of herring.



Compact recording unit is shown at right with cover and front open. Electronic parts are stock items. DC-powered by storage batteries, it uses as much current as a 40-watt light bulb. Electric pencil draws record by burning white coating off aluminum oxide paper.

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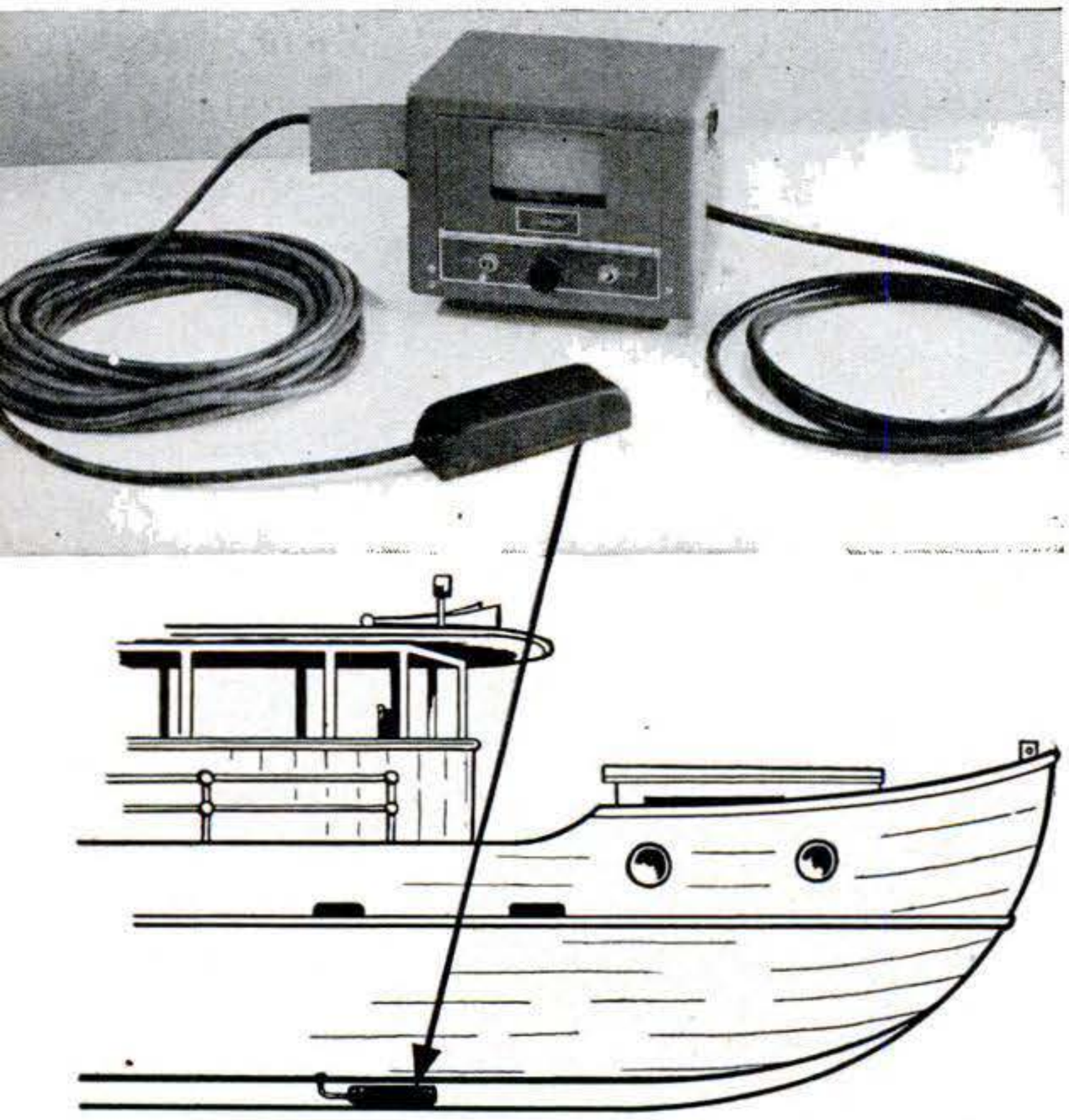
Depth Sounder For Sportsmen Locates Fish

A MIDGET version of the electronic sounding equipment used by commercial fishing vessels to locate schools of cod and tuna is now available to sports anglers for finding good spots to drop their lines.

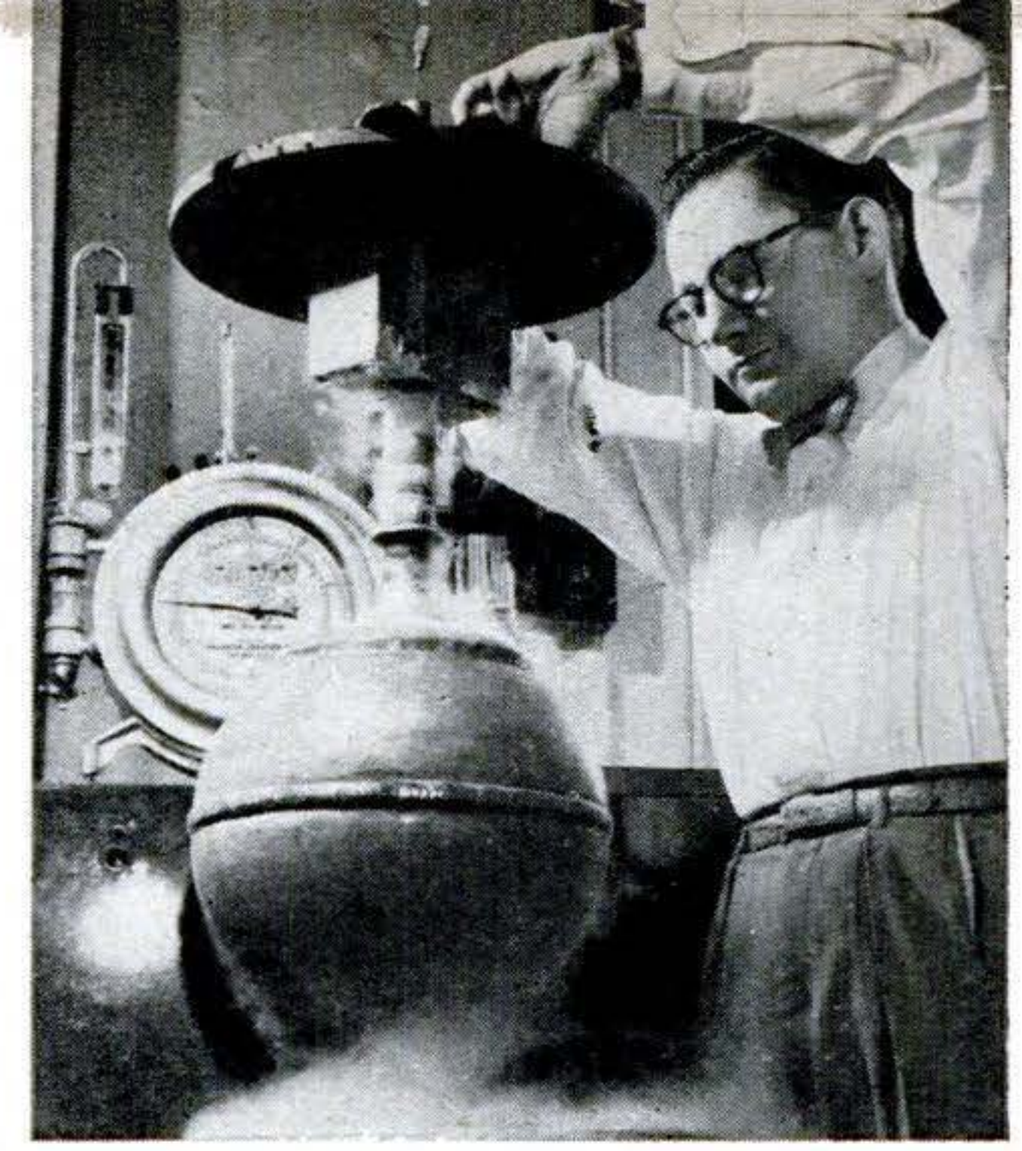
The Baby Depth Recorder, made by Bendix Aviation Corp., is easily installed in a cabin cruiser. It works on the radarlike principle first developed by the Navy in 1918 to warn ships of shoals.

A transmitter-receiver attached to the bottom of the boat sends down mechanical (acoustic) pulse signals, which travel through the water at 5,800 feet a second, and picks up their echoes from any obstruction up to 300 feet. A recorder, translating echo time into distance, then traces on a moving strip of paper a continuous picture of the sea bottom or any objects closer—even a single sardine.

Thus an angler can tell how deep the fish lie and estimate the size of a school.

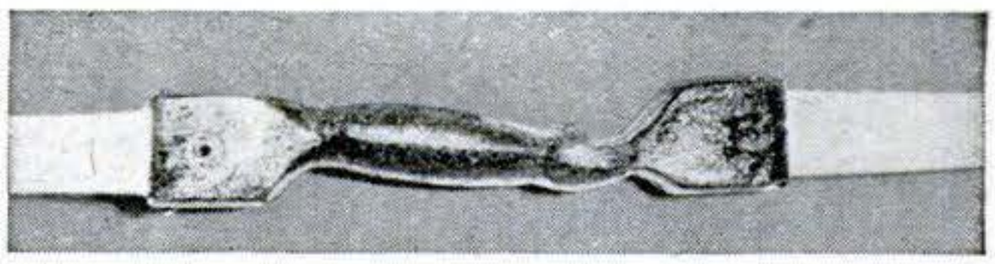


Depth sounder's "antenna," called transducer, is a combination speaker-microphone in small watertight box attached to the boat's keel and connected with recorder in pilot house.



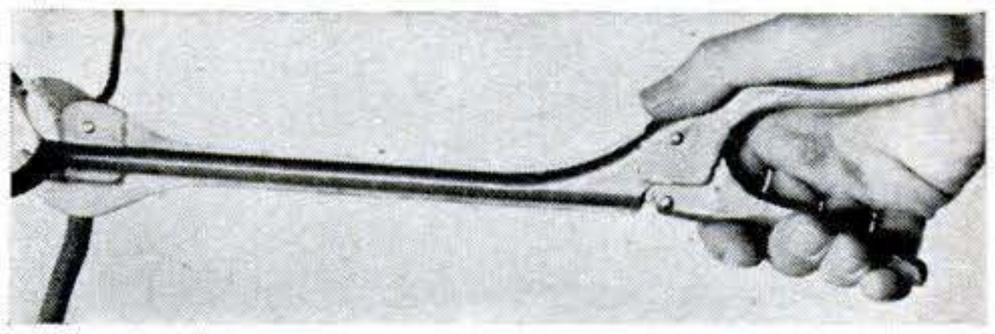
Vacuum Bottle Keeps Helium Liquid

LIQUID helium, about the coldest thing on earth, will keep for 100 days in this "super vacuum bottle." Its double-walled liner is made of two copper spheres, with the air between them pumped out. This four-gallon container—shown above held by Dr. Aaron Wexler, who developed it at Westinghouse Labs—is then put in liquid nitrogen at −300° F. A long neck helps to keep heat out during filling.



Ancient Sport Gets New Twist

AN ARCHERY enthusiast, L. R. Swanson, of Cedar Rapids, Ia., devised the bow handle shown above. Its slight twist improves accuracy, he says, by centering the arrow on the bow's axis. Since the bow is formed by two limbs fitting into sockets at each end of the handle, it is not necessary to buy a complete bow if one limb breaks.



Light Pruner Cuts Like Razor

THIS new pruning tool, with a blade of carbon steel, snips off limbs half an inch thick with an easy squeeze of the grip. Nearly 16 inches long, it weighs only 8 ounces. Wright Associates, of San Francisco, sell it for $2.50.

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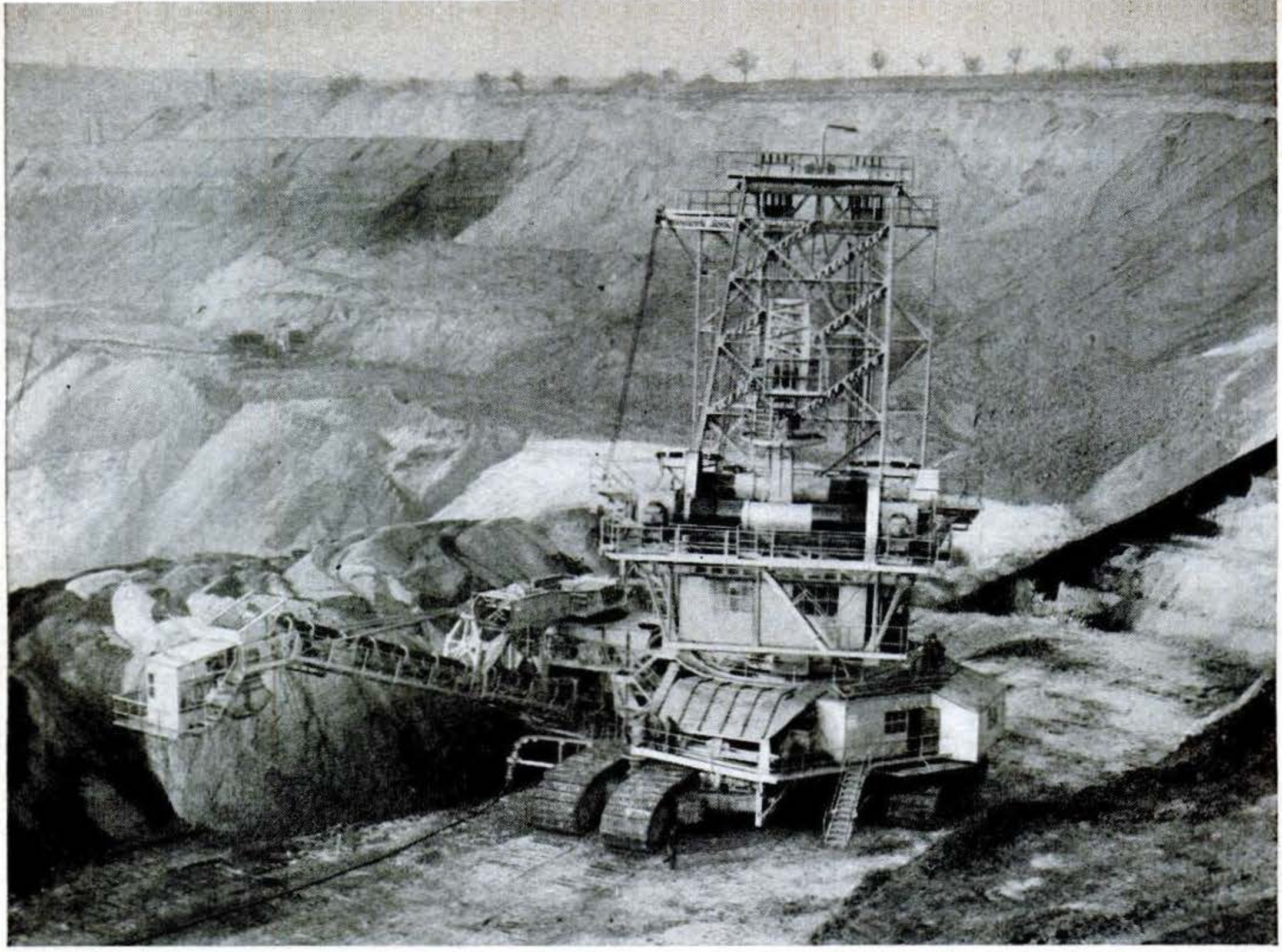
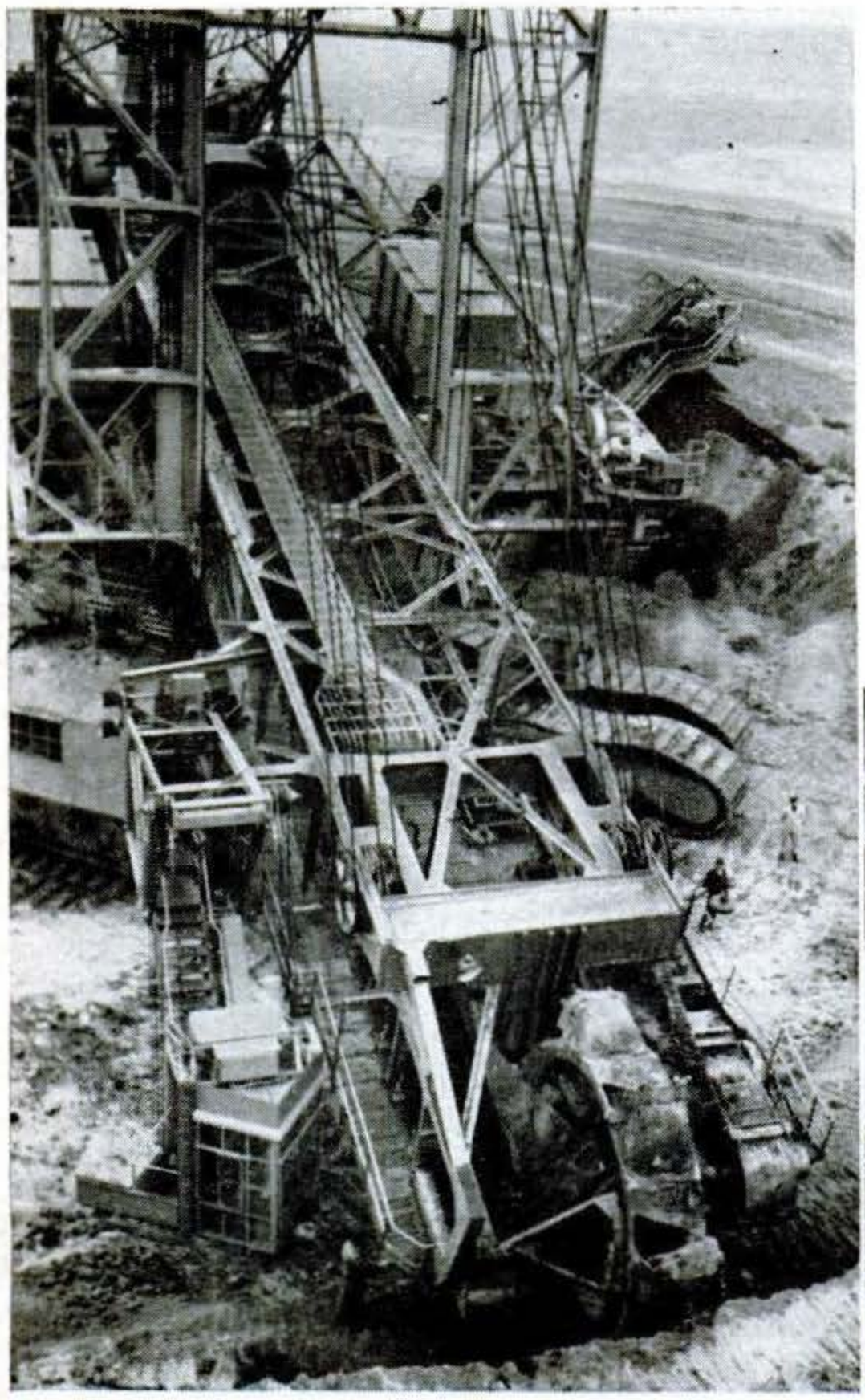


Giant excavator, which took a year to build, goes to work at open lignite mine in Germany.



Monster Machine Digs Up Coal

A MOBILE excavator as long as a city block, and taller than an eight-story building, now digs lignite (brown coal) near Helmstedt, Germany. Powered by 40 electric motors, the mechanical giant scoops up 850 cubic yards an hour. Despite its 1,100-ton weight, it treads soft ground as lightly as a man does in walking.

Scoops on revolving wheel, at end of boom, shovel up lignite and earth together. Machine separates the coal and dumps it into trucks.

Here are two of machine's six monster treads, each 7½ feet wide. They make its pressure per square inch of ground as light as a footstep.

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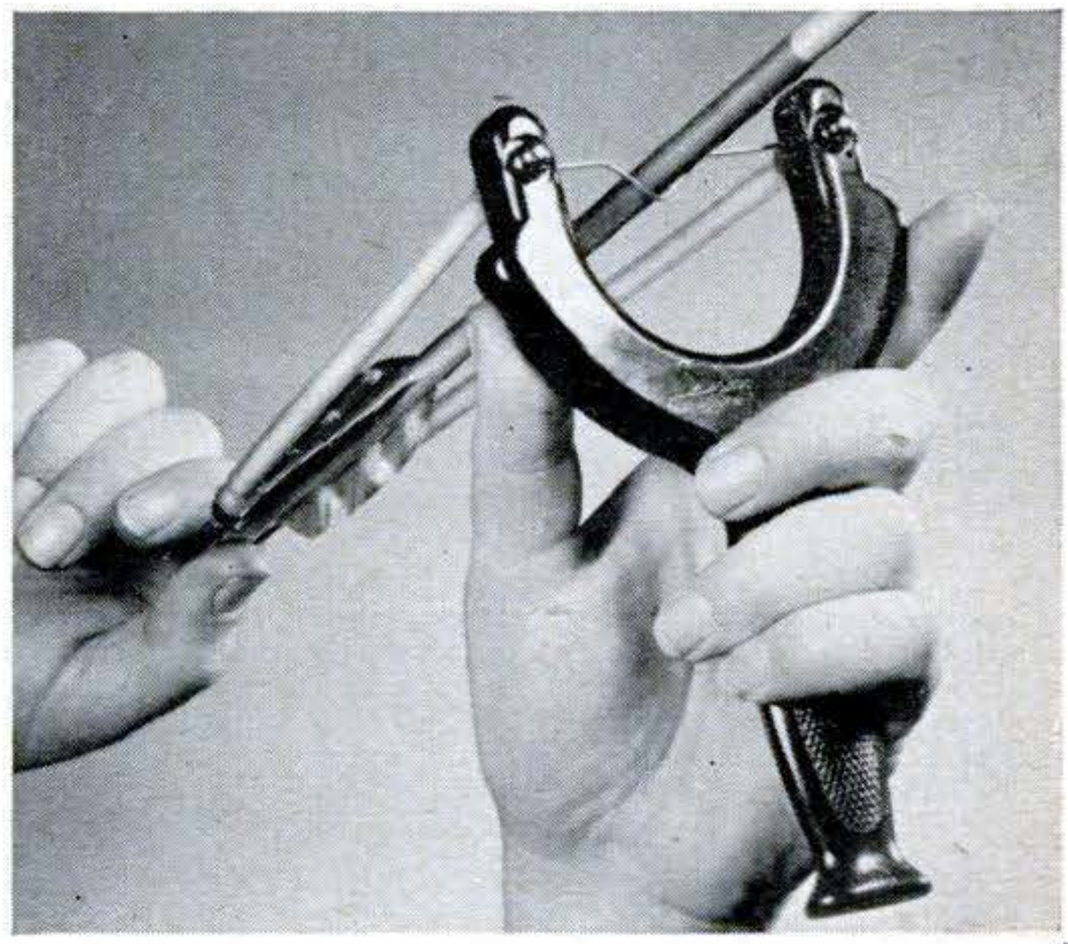
Water-Going Plastic Carrousel Won't Tip Over

One child or six can ride the horses on this amphibious "merry-go-round" without its tipping. The base and each horse are inflated separately and require only a little air pressure. Gripped between the horses' necks and tails, riders propel the plastic carrousel by paddling water with their legs. When deflated, the 7-foot toy measures 16 by 16 by 4 inches, and weighs 8 pounds. Bilnor Corp., Maspeth, N. Y. makes it.

Seven Heads for One Golf Shaft

In this new golf set, four interchangeable heads and one shaft provide a player with the equivalent of seven different clubs. They are driver-brassie, chipper, putter, and No. 1, 4, 7, and 9 irons. An angled T-lock holds the club heads to the shaft. Reversing it changes the angle so that the No. 1 becomes a No. 4, the No. 7 becomes a No. 9, and the chipper becomes a putter. Invented by John J. Jokosky, the three-pound set is available from the Trija Golf Club Co., of Miami, Fla., for about $45.



Weapon Is Bow or Slingshot

For target practice or hunting small game this plastic Sling-Bow shoots either arrows or ordinary slingshot ammunition. When used with arrows, a removable wire guide is placed over the "bow's" crotch, as above. Arrows of various sizes, and rubber slings with pulls ranging from 10 to 35 pounds are available. A leather cradle is attached to the strand when it is used as a slingshot. Made by Glo-Lure, Inc., of Medford, Wis., the bow has indented rests for thumb and forefinger.

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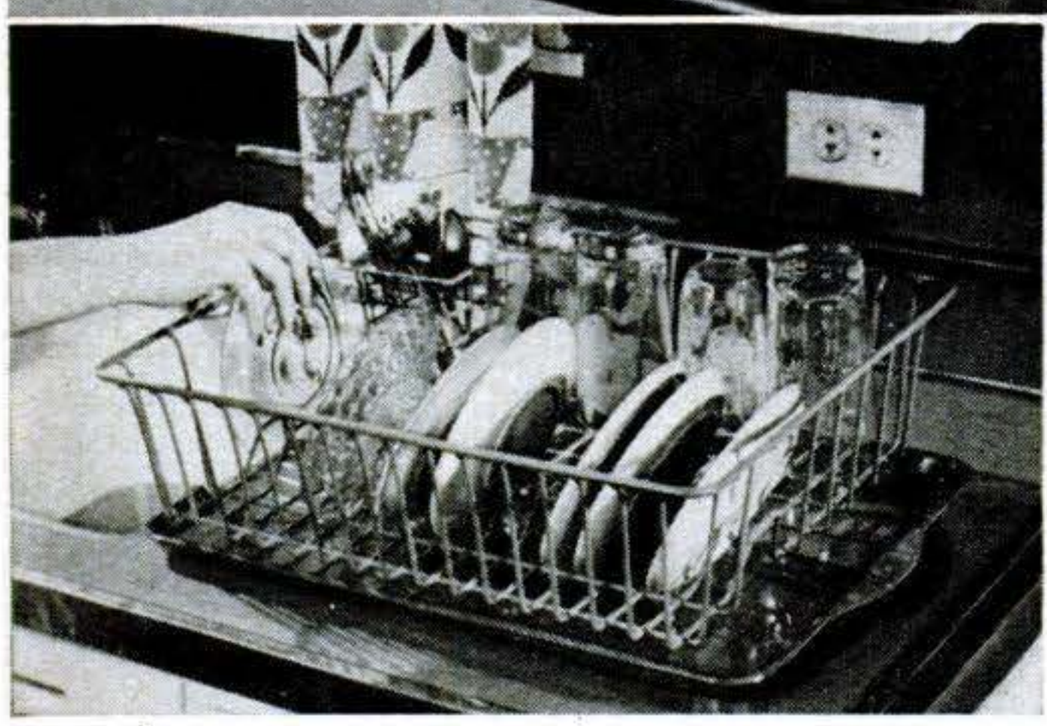
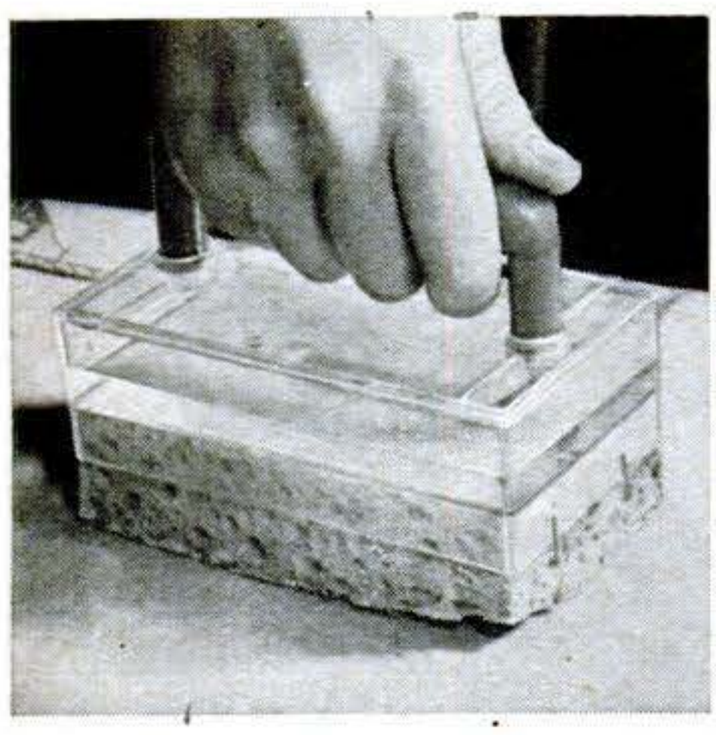
Aids to Modern Living

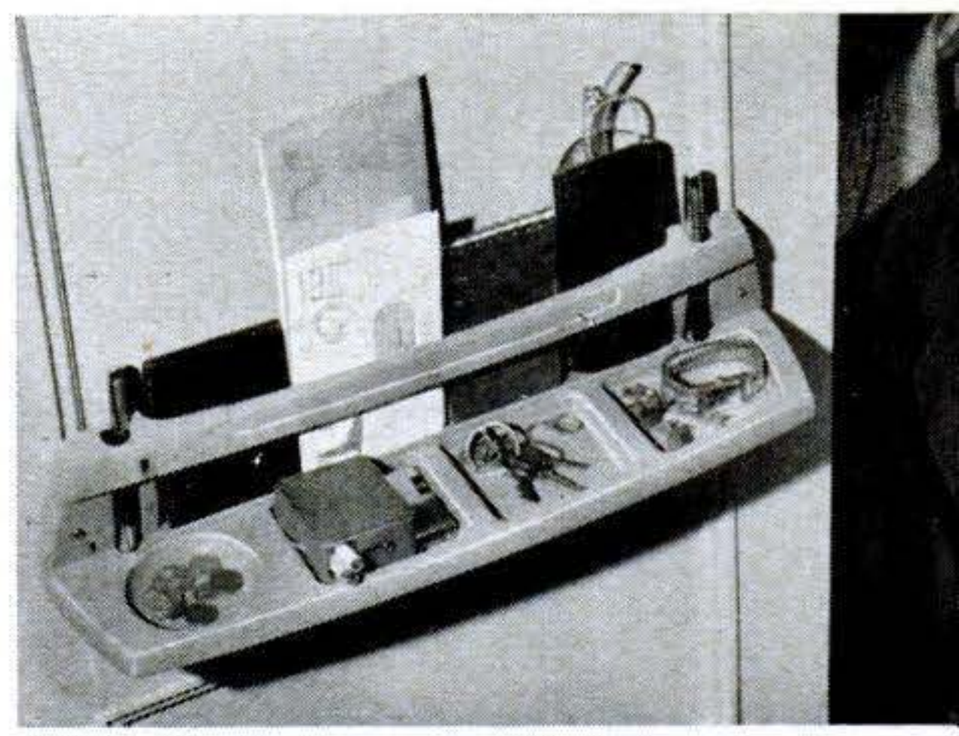


Tray Doubles as Drainboard. When this serving tray is used for draining dishes, as at left, water flows off into the sink, but the tray remains level when placed on a table. Made of lightweight Bakelite, it resists heat, detergents, and abrasion. It is available from Artwire Creations, Inc., of Suffern, N. Y., for about $3.50.



Sponge Stays Wet. This sponge, for dampening clothes to be ironed, is fitted to a plastic container that feeds water when a handle trigger is pressed. David Traum Co., N.Y.C., sells it for $2.

Stove Is Portable. A copy of a stove used in the Philippines, this outdoor clay broiler is said to give hot coals in five minutes. Pronto Broiler, Los Angeles, sells it for $10.



Rack for Pocket Contents. The things you carry in your pockets won't be mislaid during suit changes if you place them on this plastic door tray. Alexander Hertz Co., Forest Hills, N.Y., prices it at $3.50.

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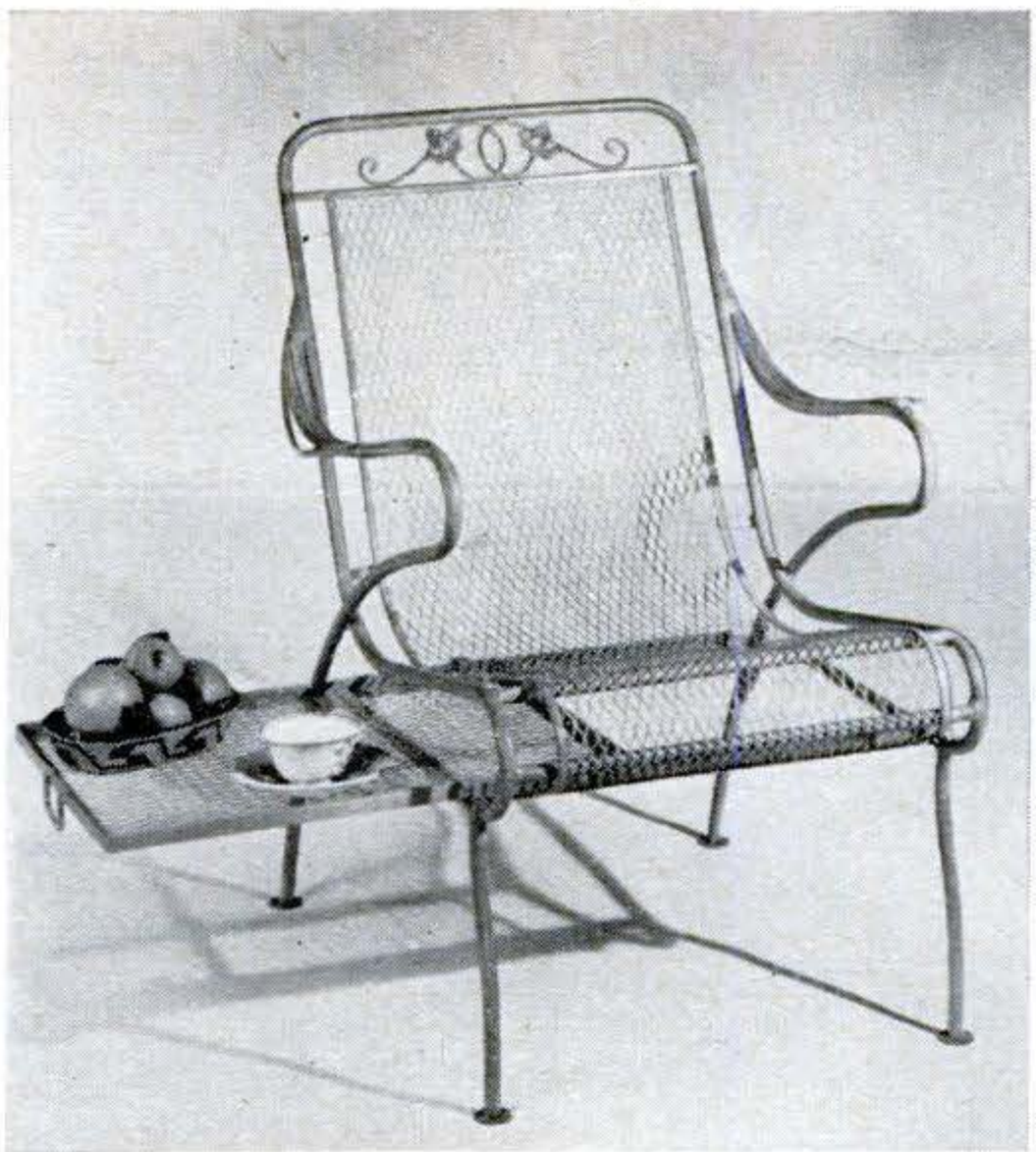
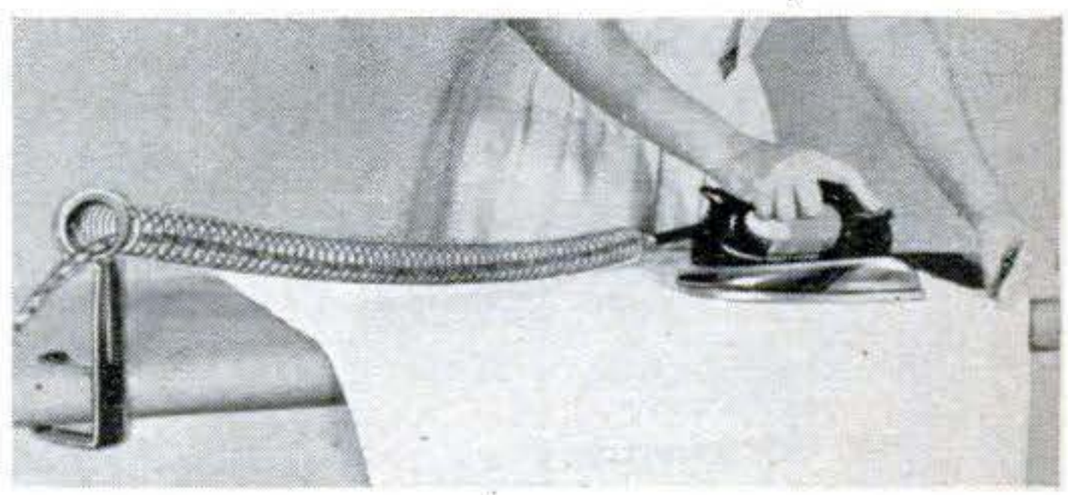
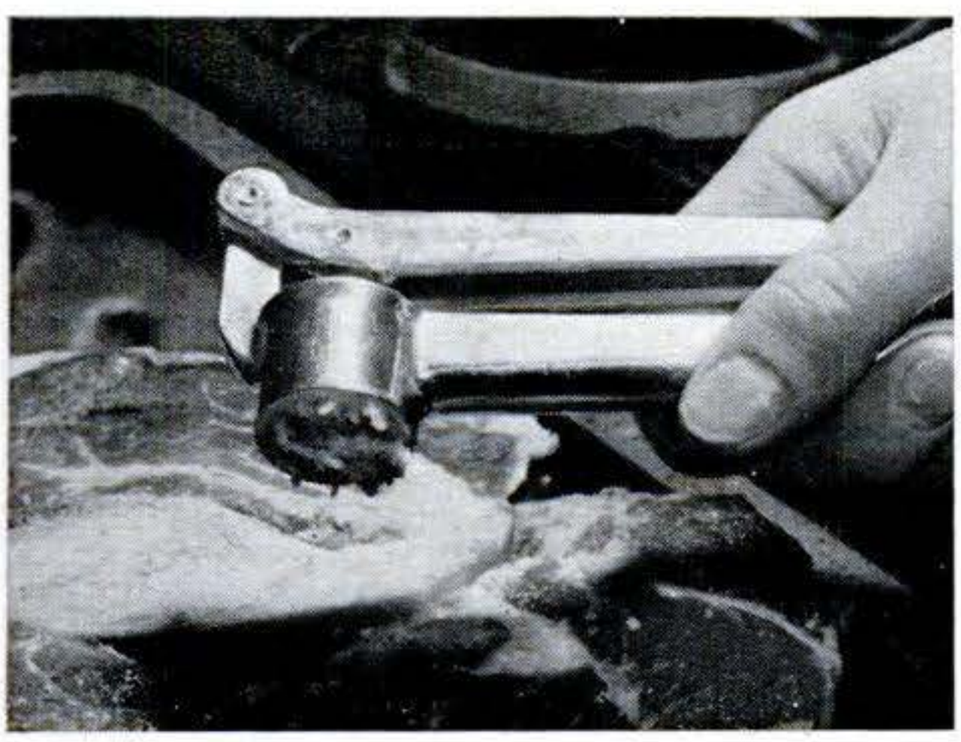


Chair Has Sliding Tray. Part of a line of outdoor furniture using Wheeling expanded metal (slit and stretched steel), this chair is said to be rust- and snagproof. The sliding tray is pushed under the seat when not in use. Sta-Out furniture is made by John B. Salterini Co., N.Y.C., costs from $20 to $60.

Dial Lights Up. When you pick up the receiver, the attachment on the phone above illuminates both the dial and a tab for emergency numbers. Flicking a switch changes the device to a night light. It plugs into a 110- or 115-volt outlet. Nite-Tel-Lite, Inc., Canton, O., prices it at about $5.

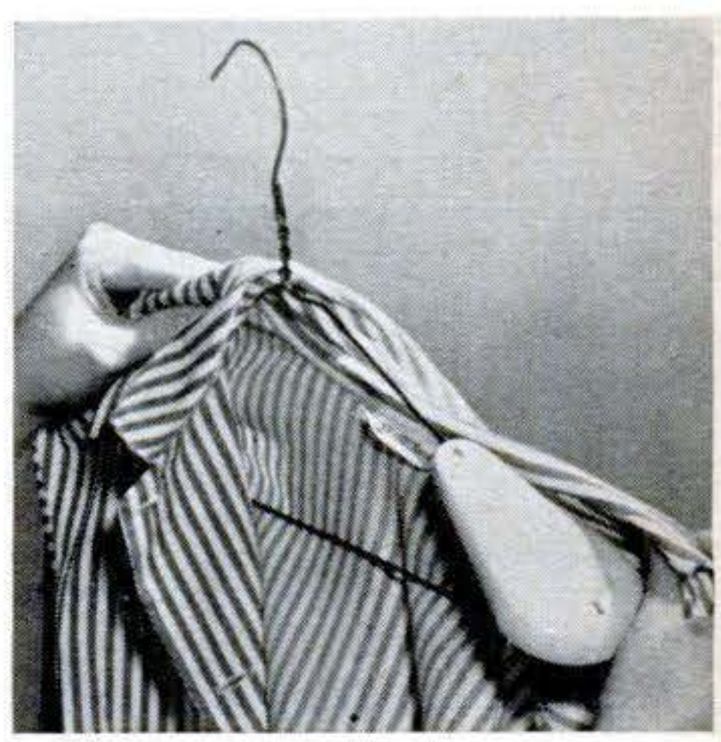
Cord Won't Twist. If you slip the spiral steel spring at right around the iron's cord and clamp it to the board, the cord not only won't tangle, but will lift out of the way to prevent wrinkling and soiling of clothes. Kordaway, made to fit any iron, is available from Homemakers' Mart, Beverly Hills, Calif., for about $2.





Press Squeezes Garlic. To mash garlic without staining your hands, squeeze it through the holes in this press. Imported from Italy, it is sold by Damar Distributing Co., Newark, N J. for $1.98.

Cover Locks in Place. A new plastic cover for the top of the Cory coffee maker also serves as a locking handle, preventing the upper bowl from slipping when it is lifted out.



Hanger Pads Snap On. Attached to the ends of a wire hanger, these plastic Hangerette shoulder pads keep hanging garments smoother at the shoulders. Roberts & Co., Chicago, sells four sets for $1.

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Do You Know Your 1951 Cars?

1 _____ 2 _____

5 _____ 6 _____

9 _____ 10 _____

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HOW many '51 automobiles can you recognize at a glance? Which U. S. car has had the most elaborate redesigning job done on its front end?

Here are twelve of the new cars. If you know all of them, you've got a sharp eye. Eleven is good, ten only fair. Answers are printed upside down in the adjoining column.

1, Plymouth; **2,** Packard (the answer to the second question in the opposite column); **3,** Willys (there's practically no change there); **4,** Oldsmobile; **5,** Hudson; **6,** Nash; **7,** Chevrolet; **8,** Studebaker; **9,** Buick (those long front teeth have been pulled); **10,** A poser? Well, this is the British-made Hillman Minx; **11,** Henry J; and finally, **12,** Ford.

3 _____

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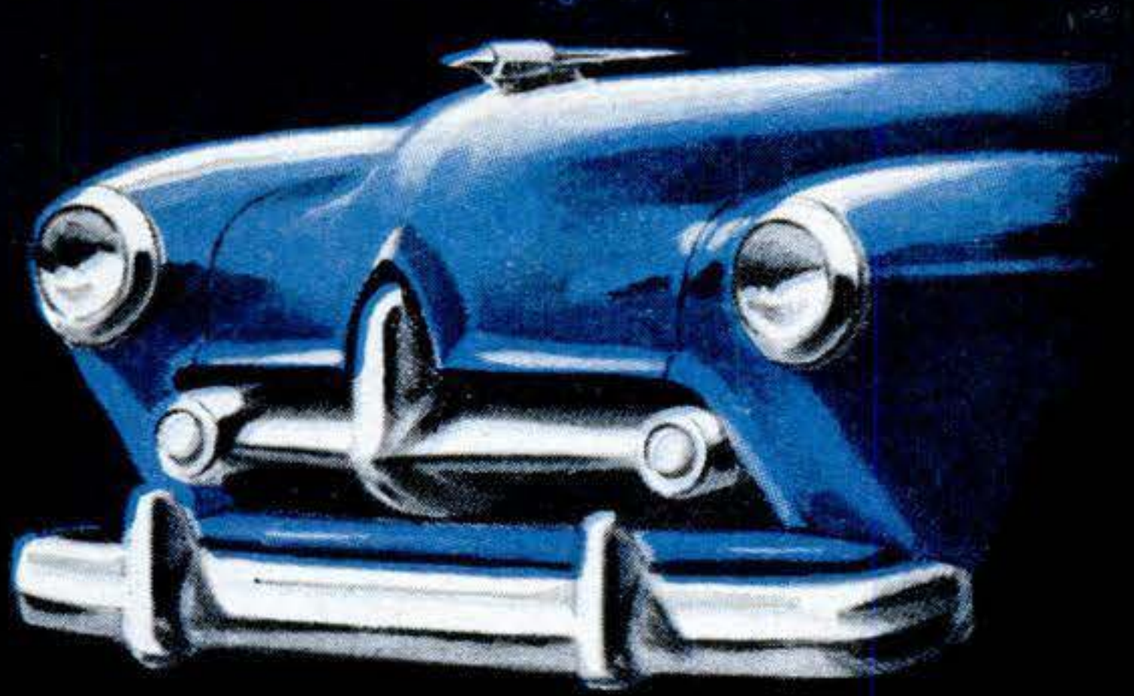

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12 _____

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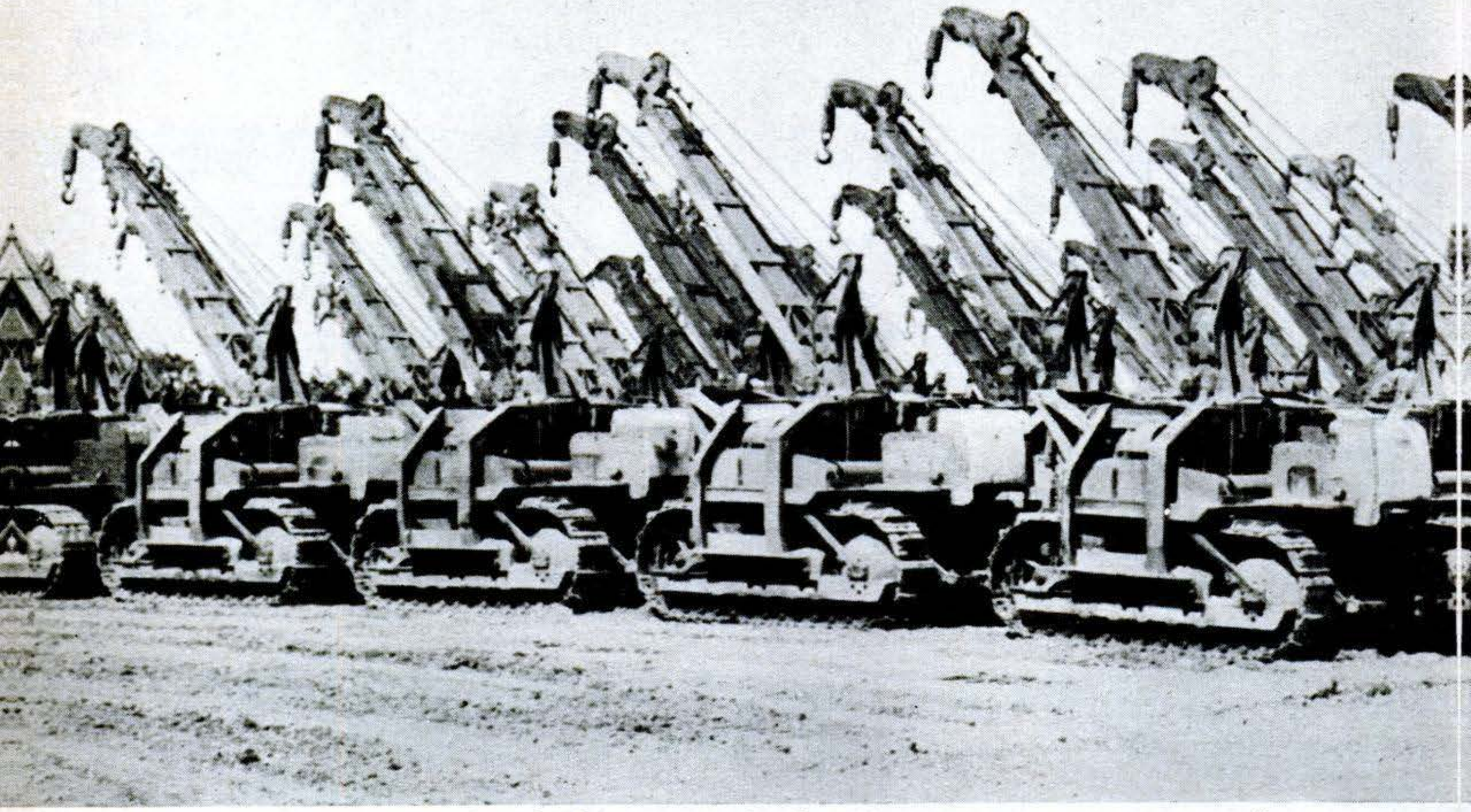
Navy's Cannibals Save



Once abandoned to rust in the island graveyards that World War II left behind in the Pacific, these D-6 tractor cranes are now ready to build for defense again wherever they are

Against background of thousands of pontoons awaiting reclamation, worker sandblasts one. Man at left is "safety," ready to help in case fumes overcome his partner holding the nozzle.

Small equipment, too, is repaired when salvage can save the Navy money. Above, workmen scrape carbon-dioxide fire extinguishers. Later they will repaint them and test the valves.

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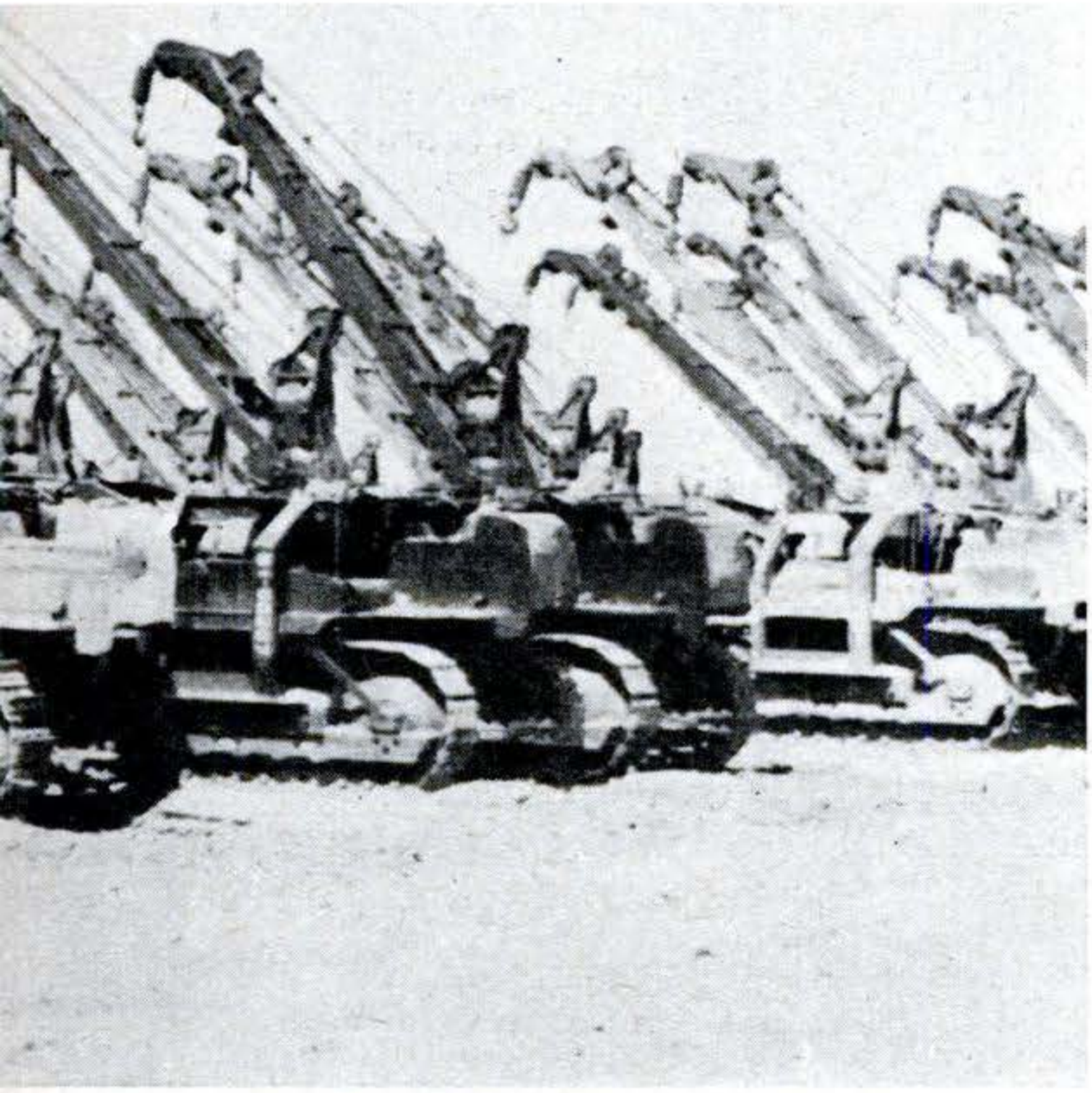
You Money

War machines, once left to rot in Pacific island junk yards, are being reclaimed by Navy's giant salvage operation.

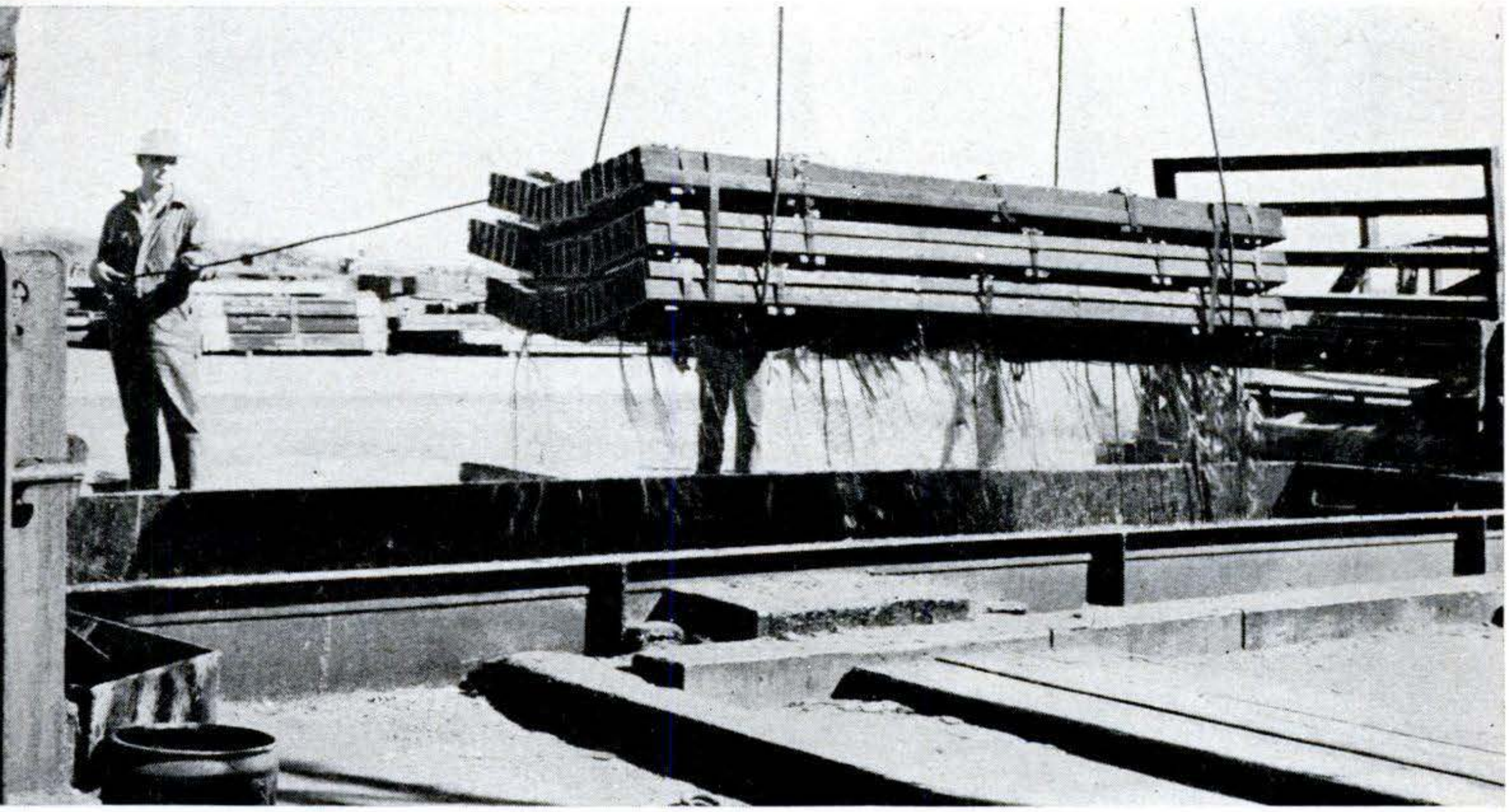


needed. They are part of 50 shiploads of Seabee equipment being returned home for salvage.

MACHINES that paved the way for victory in the Pacific in World War II are being rebuilt to serve again in a super salvage operation in California. They were abandoned in 1945 to rust on island steppingstones, from Guadalcanal to Okinawa, because salvage and shipping would have cost more than they were worth new.

But now rising prices and material shortages have changed that situation, and 50 shiploads of valuable machines needed by the Seabees are being brought back to the Port Hueneme Naval Base. There a crew of 110 skilled machinists and repairmen will go to work on them. For $3,000,000 worth of repairs, the Navy expects to get $14,000,000 worth of good-as-new equipment—everything from heavy cranes and Quonset siding to fire extinguishers.

The biggest part of the job is just scraping, sandblasting, and repainting. In other cases, several junked machines are cannibalized to make one that works. Already more than 2,200 items of Seabee equipment have been reclaimed. Even stuff that finally had to be junked brought $4,000,000. END



These sections of steel were once part of a Quonset hut on Guam. Shipped back to Port Hueneme for reclamation, they are shown above being lifted from a tank filled with a mixture of fish oil, tung oil, and mineral spirits. This solution loosens scale, and also combines with the rust to form a paintlike film that will resist further corrosion.

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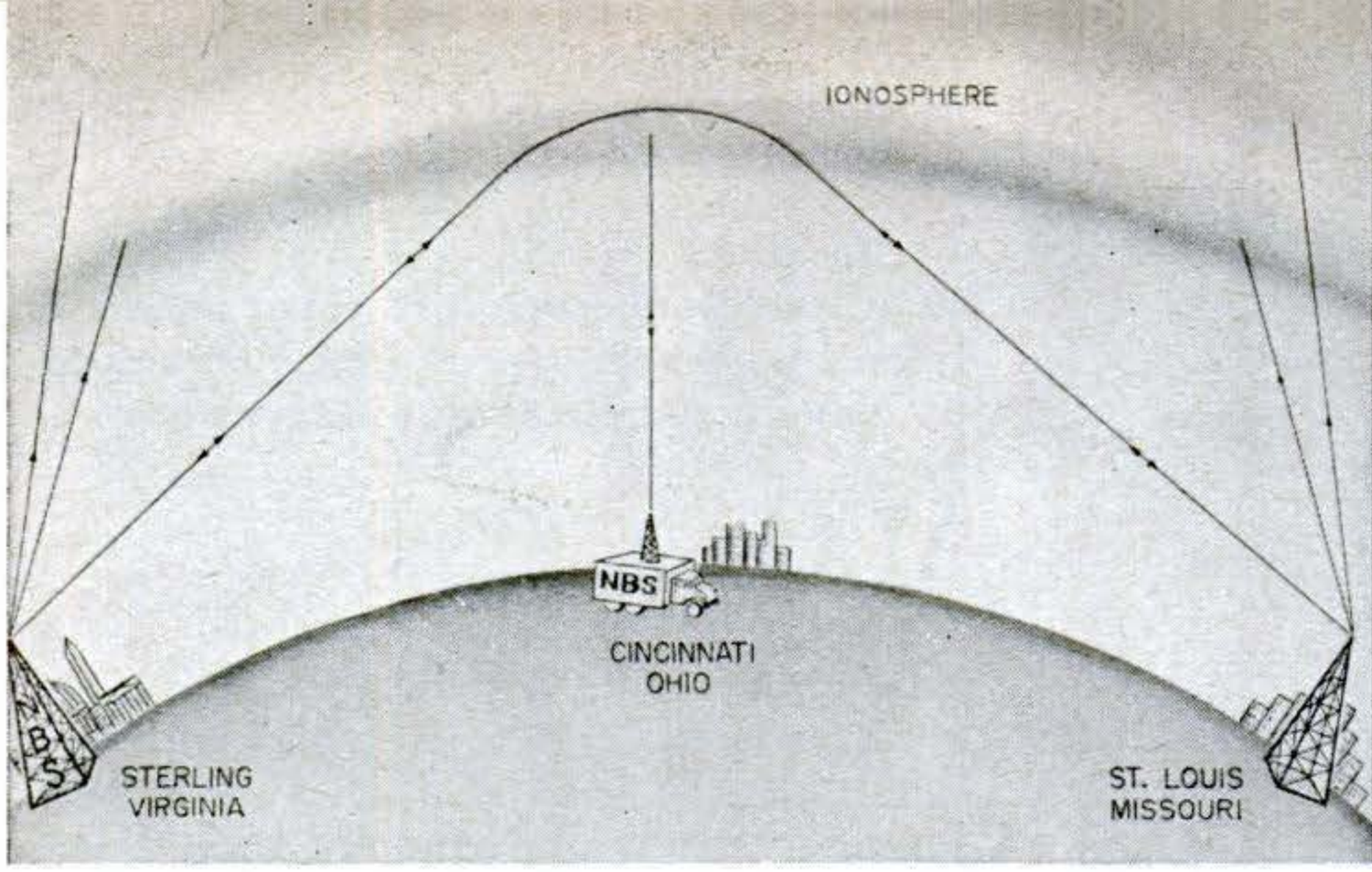


Mobile Lab Probes Sky Mysteries

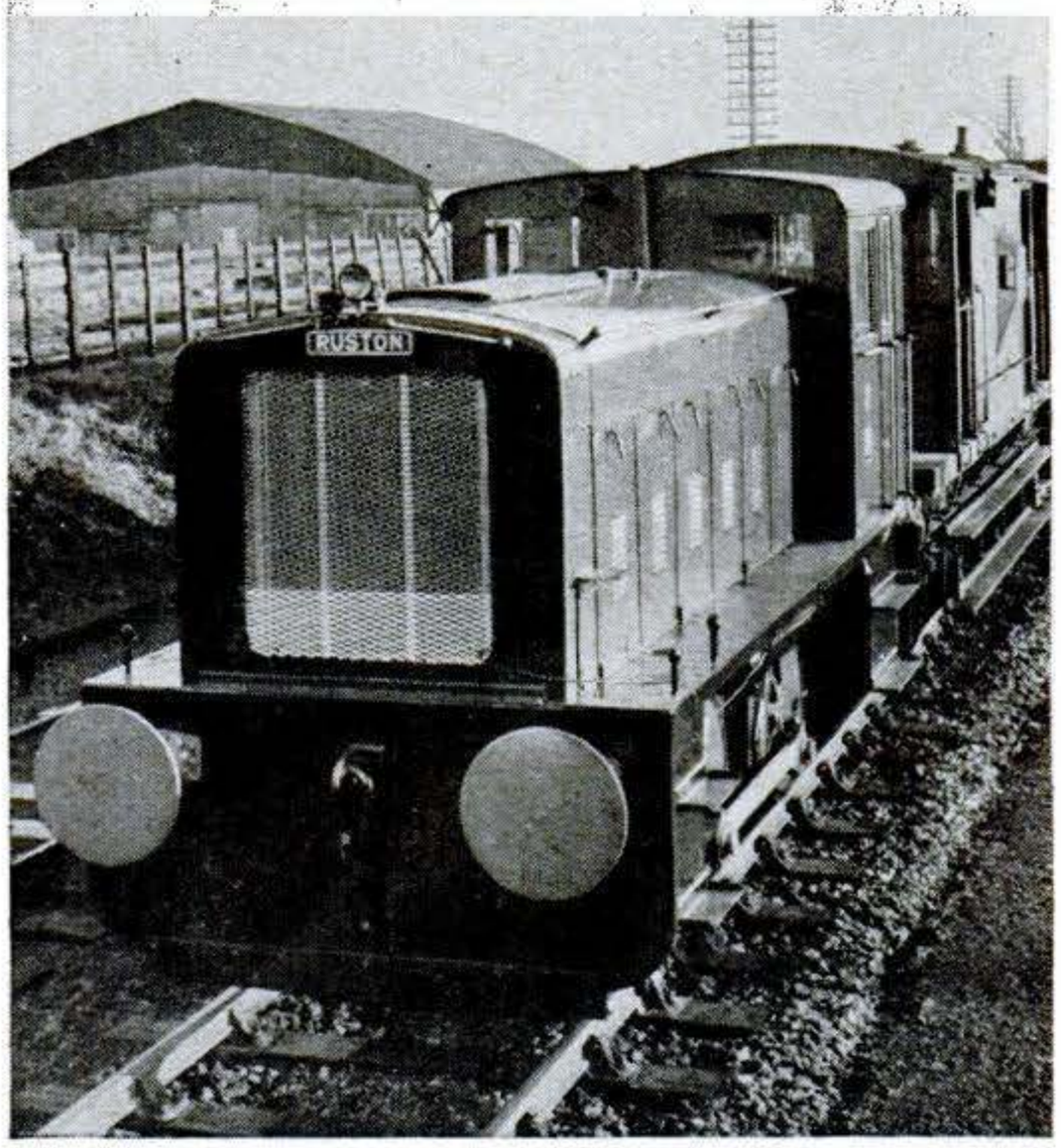
To solve the mystery of fading radio reception and improve long-range communication, the National Bureau of Standards has put a roving laboratory in the field.

The lab, traveling in two trucks and trailers, includes two 10,000-watt generators, a high-powered radio transmitter, and receiving and recording devices. It will study the effect of the ionosphere on radio waves. These electrically conducting layers 50 to 200 miles above the earth bounce radio waves back to earth, making possible long-distance transmission beyond the horizon. But the height and density of the layers, which determine the angles at which the waves are reflected, change continually, affecting different operating frequencies.

The mobile unit will take measurements of ionosphere height and reflection angles to determine the best frequency for any time or season. First stop is halfway between permanent radio stations at Sterling, Va., and St. Louis.

Rope Serves as Clutch for Hoist

The rope on this homemade milk-can hoist acts as its own clutch. Wound freely around the motor-driven drum, it tightens when the operator pulls it taut, and the drum hoists up the can. When the operator relaxes his pull, the rope slips, and the can is lowered by its own weight. Ellis and Chester Anderson, of Castleton, Vt., built it.



Tiny Diesel Loco Fits Many Gauges

This English-made, 28-ton diesel-electric locomotive, one of the smallest, is built in various gauges from narrow to 5′ 6″. The flexibility of its electric transmission enables it to adjust quickly to any load condition and to eliminate overloading or stalling. It develops 18,000 pounds of traction at starting and has a top speed of 17½ m.p.h.

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There was death in this flaming explosion, set off when a farmhand lit a cigarette while T. C. Gains, a young Arizona rancher, was filling the gas tank of a tractor. But photo at left shows him smiling and healthy today—thanks to ACTH.

How Hormone Team Is Saving Lives

ACTH and cortisone help your body fight all kinds of harm—from arthritis, burns, and blindness to hangovers.

By John E. Pfeiffer

DRAWINGS BY RAY PIOCH

A YOUNG Arizona rancher, T. C. Gains, was dying in the emergency ward of the Santa Monica Hospital in Phoenix. He'd been filling the gas tank of a tractor when a careless farmhand lit a cigarette and touched off the fuel. Gains' clothing immediately burst into flame. By the time neighbors put out the fire, he was terribly burned and suffering from severe shock.

Judging by past records, Gains would be lucky to last out the week. Damage covering as much as half the surface of the body is almost invariably fatal—and 71 percent of his skin was critically burned. Transfusions of blood plasma, special Vaseline dressings, and other treatments didn't help.

Finally, as a desperation measure, doctors tried injections of a new gland extract. The

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How cortisone is produced in the body

doses were tiny, less than a thousandth of an ounce every six hours. But that was enough. The shots produced such dramatic results that all other treatments were discontinued, and doctors watched a near-miraculous recovery. The body's tissue-building mechanisms spurted into activity and began turning out millions of new cells.

Within a fortnight skin was growing back on Gains' hands, face, and neck. A few weeks later specks of fresh tissue appeared on his chest and back. Even more surprising, skin grafts that were expected to slough off "took" beautifully. Grafts usually fail to take unless they come from an identical twin or the patient's own body. The right leg of the victim was so badly seared that he required forty grafts from "foreign" donors, and all but one grew into healthy skin.

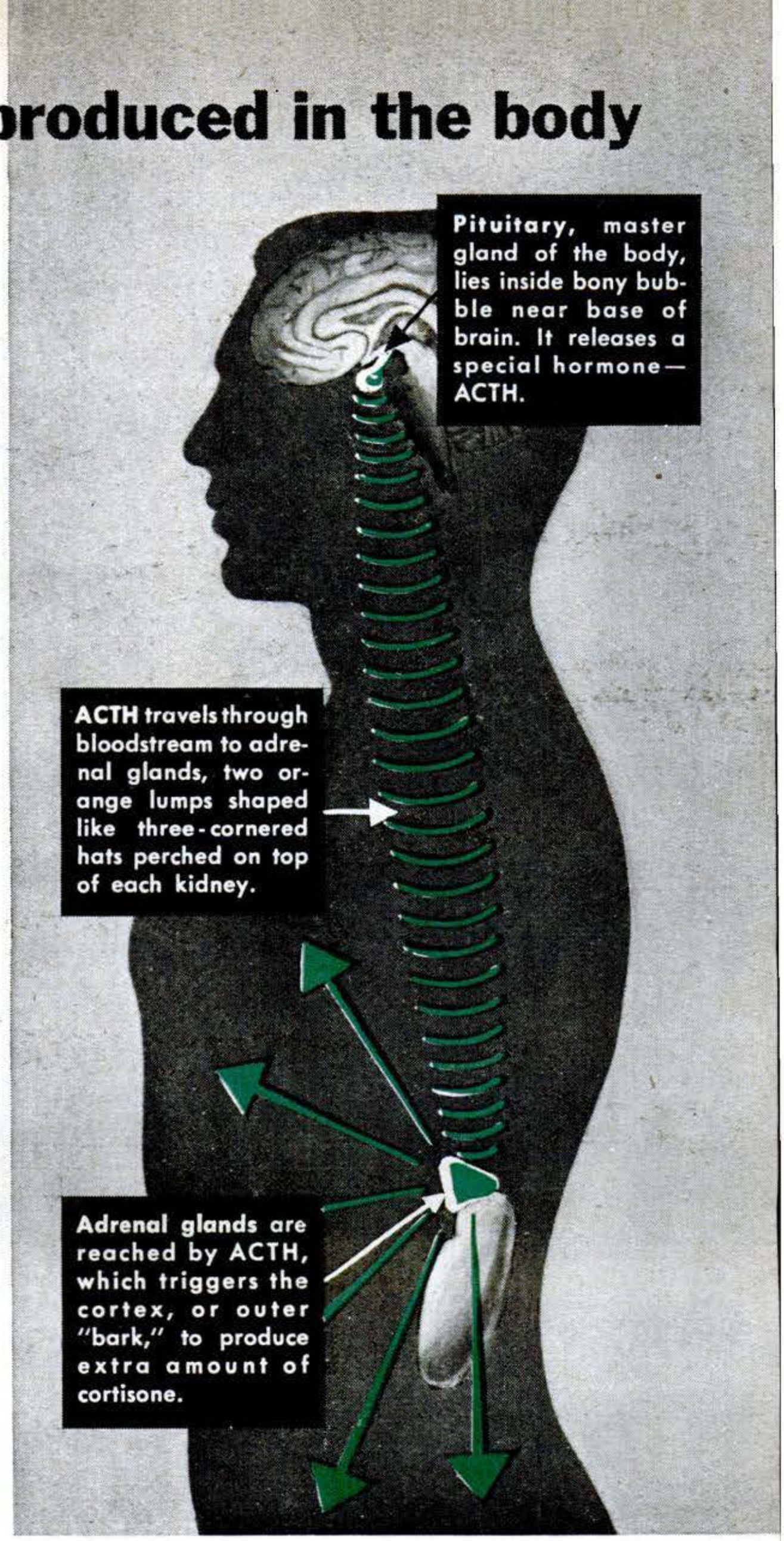
ACTH Performed the Magic

This case, which was announced at a recent meeting of the American Medical Association, is only one among many in the bulging files on two spectacular drugs—ACTH and cortisone. The young rancher was saved by ACTH, but cortisone would have worked just as well. Both substances produce practically the same effects. Cortisone is secreted by the cortex, or outer layer of the adrenal glands, two orange lumps shaped like three-cornered hats and perched on the top of each kidney.

ACTH, a different hormone, is simply a round-about way of getting cortisone. It's produced by the master gland of the body, the pituitary, which lies inside a bony bubble hanging from the base of the brain. This hormone is a "trigger." Released by the pituitary, it travels through the bloodstream to the adrenal cortex and stimulates it into producing extra quantities of cortisone. The letters ACTH stand for AdrenoCorticoTropicHormone.

Whether you trigger it or use it directly, you end up with the adrenal hormone cortisone. One difference—and it's an important one as far as patients are concerned—is that stomach acids destroy ACTH rapidly, so that if it is to be used, it has to be injected. Cortisone, however, can be taken by mouth.

The hormones represent an entirely new approach in the art of healing. Penicillin, streptomycin, the sulfa drugs, and most other medicines you've been reading about



are poisons intended specifically to attack invading germs. The body doesn't manufacture them and they're not supposed to affect normal tissues. But ACTH and cortisone are not germ-killers. They are natural products, gland hormones. They influence the body's built-in chemical factories that go into action whenever extra supplies of tissue are required.

In disease or injury the factories may run down, and cells aren't produced fast enough to replace worn-out tissue. Although cortisone and ACTH don't build new tissues themselves, they may start the wheels turn-

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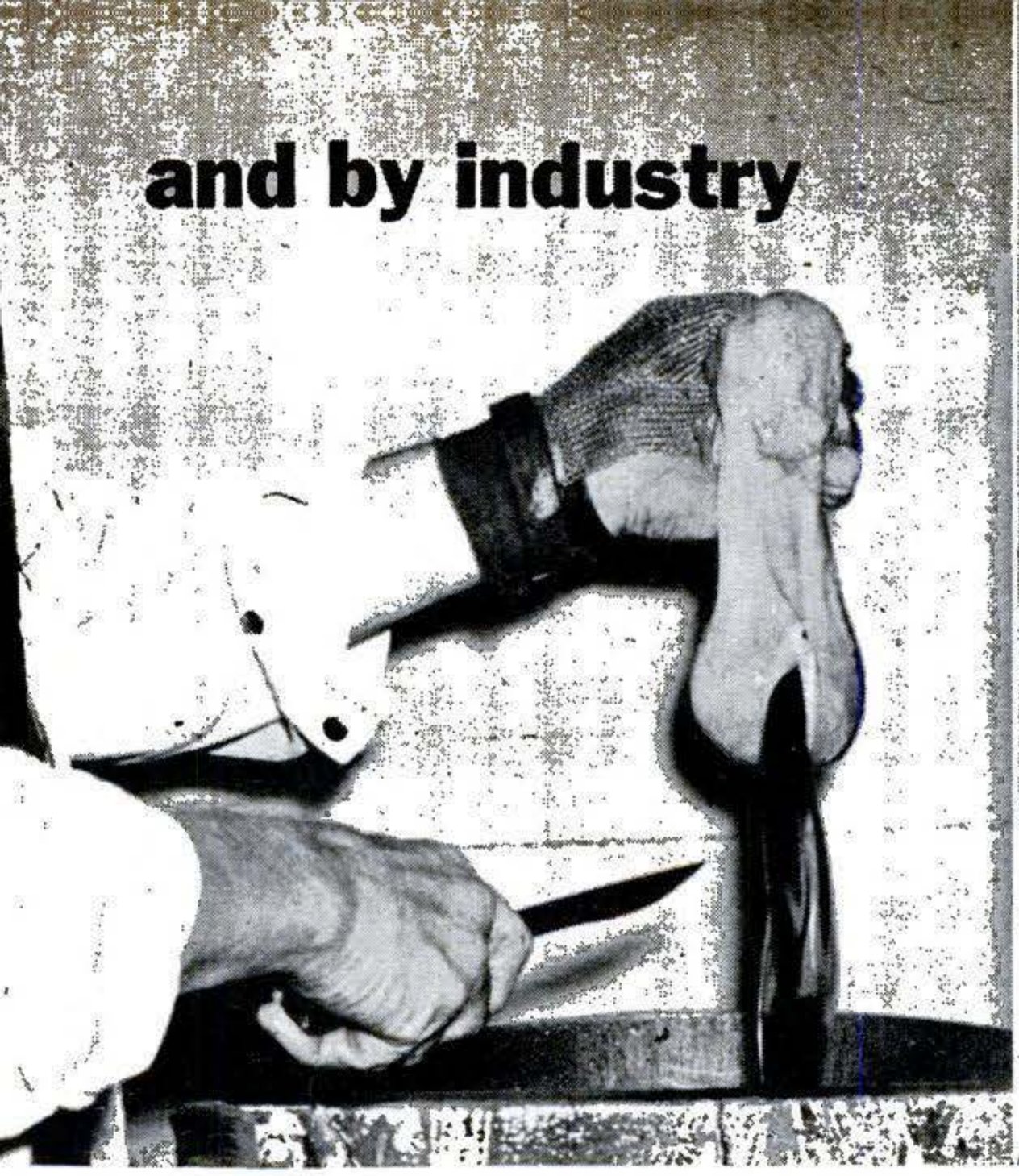
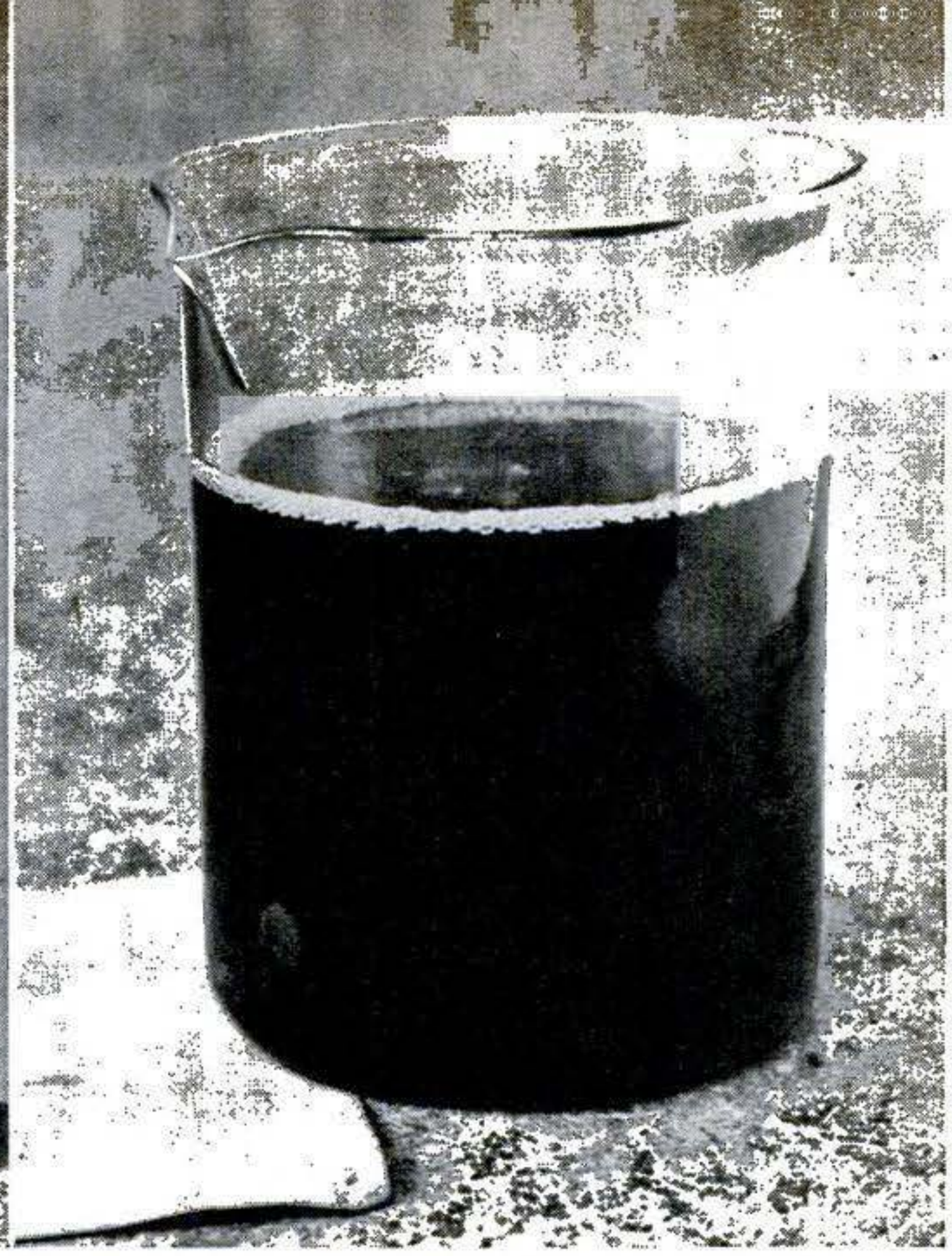
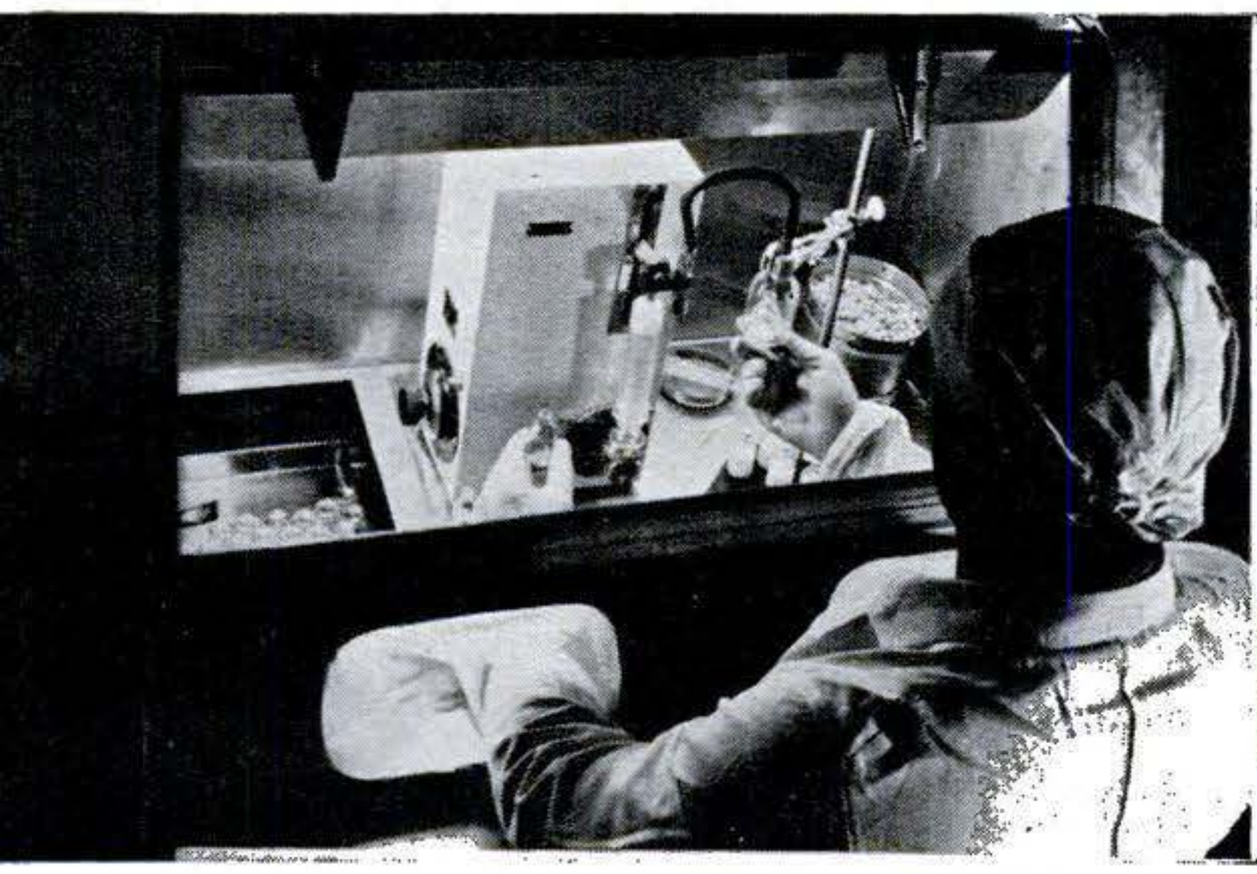
and by industry



Cortisone starts with the bile juices from cattle. Medical by-products bring meat packers as much money as the choicest cuts of steak.



After extraction, bile juices look like this. Their acids are put through 30 separate chemical steps before becoming life-saving drugs.



Lab worker above is filling vials with a cortisone powder solution for injection.

The drug also is pressed into 25-milligram tablets, costing patient about 75 cents each.

ing again, and thus help remake damaged organs. For example, in severely burned patients they drive the "machine" that produces skin cells, covering underlying tissues with fresh, protective layers.

Perhaps the most publicized use of the drugs is in rheumatoid arthritis, a condition afflicting up to 3,000,000 Americans. A typical arthritic joint is inflamed and swollen as much as twice its normal size.

The hormone can reshape such a deformed joint into a smoothly working fulcrum. Pain disappears, and the accumulated debris dissolves. Furthermore, destruction of supporting tissue is stopped in its tracks for months and fresh cells may come in to repair the damage. Drs. Edward C. Kendall and Philip S. Hench of the Mayo Clinic, who shared a 1950 Nobel Prize for pioneer

Cortisone "Parent" Synthesized

THE frantic hunt for a way to make cortisone synthetically from common minerals may be ended. A compound that probably can be converted into cortisone has been synthesized from coal tar by Harvard's Dr. Robert B. Woodward. Cortisone is next.

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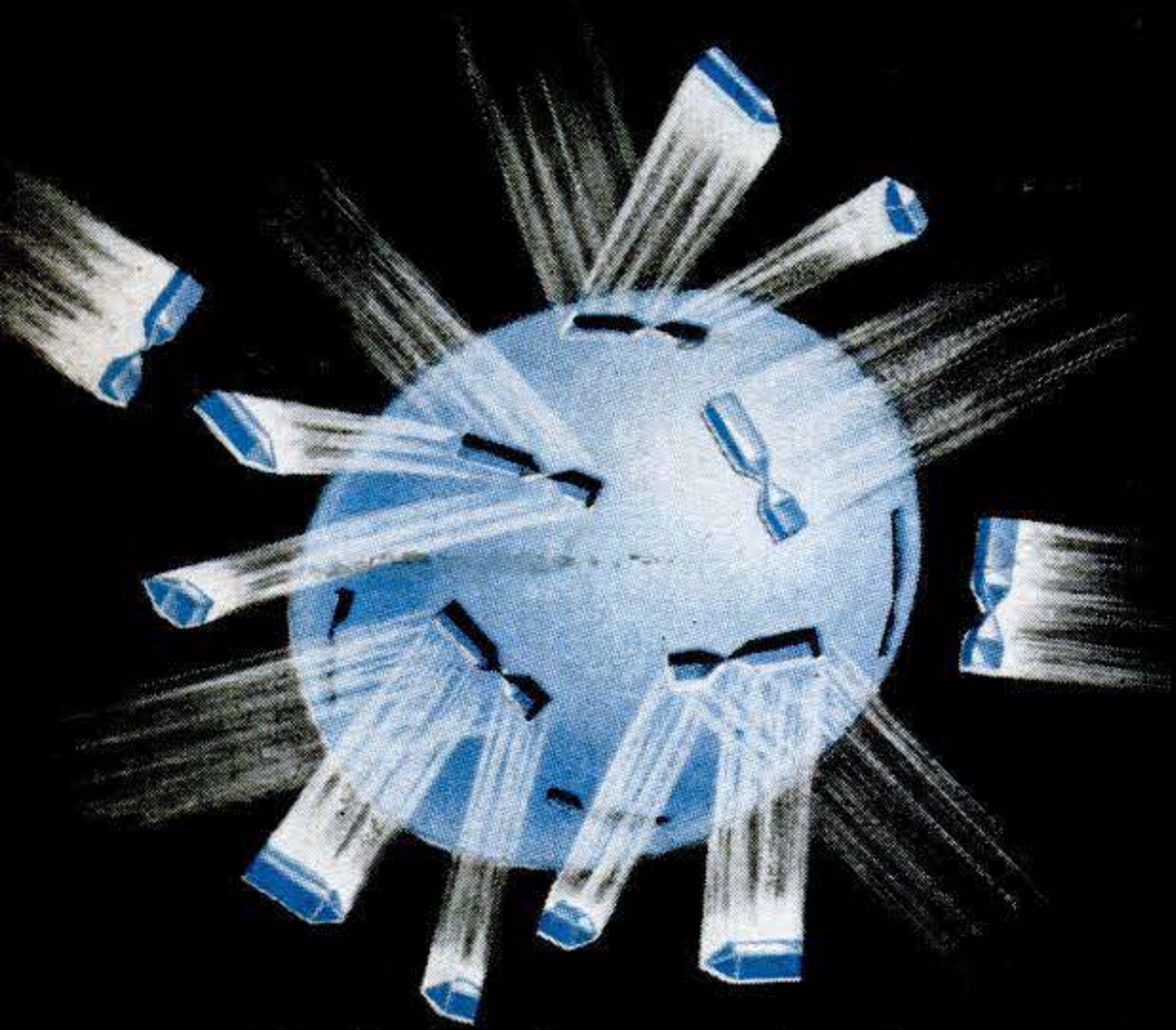
This may be the way that cortisone relieves the pain of arthritis



Good health depends on properly working enzymes, substances that speed vital reactions in the body. Here they are visualized as globe-shaped particles with unique patterns of notches and dents in their surfaces. Molecules of tissue debris collecting in the body are "keys" that fit into these "locks," where they are broken down and eliminated as wastes.

In an arthritic joint, the patterns may be clogged with poisons, as in drawing above, so that debris can't fit into enzyme locks—and isn't destroyed or eliminated. Cells and fluids accumulate around joint and cause painful swelling.

According to one theory, cortisone may have a "washing out" effect. It may remove the poisons that clog the surfaces of enzyme particles, thus preventing the breakdown of tissue debris. This puts the enzymes back in normal working order. The result: debris is eliminated and swelling disappears.

studies of the new drugs, point out that beneficial effects usually appear within three to five days after the first dose.

In New York a middle-aged housewife was confined to a hospital bed with agonizing arthritis of the shoulders, knees, neck, and hips. One Sunday morning she received 300 milligrams, about a hundredth of an ounce, of cortisone. The dose was reduced to a third of that for the following few days, and by Wednesday the patient got out of bed for the first time in five months. Next day she went shopping. That was more than half a year ago, and today she's living a normal life with the aid of three 25-milligram tablets every 24 hours.

ACTH and cortisone are effective in rheu-

[*Continued on page 216*]

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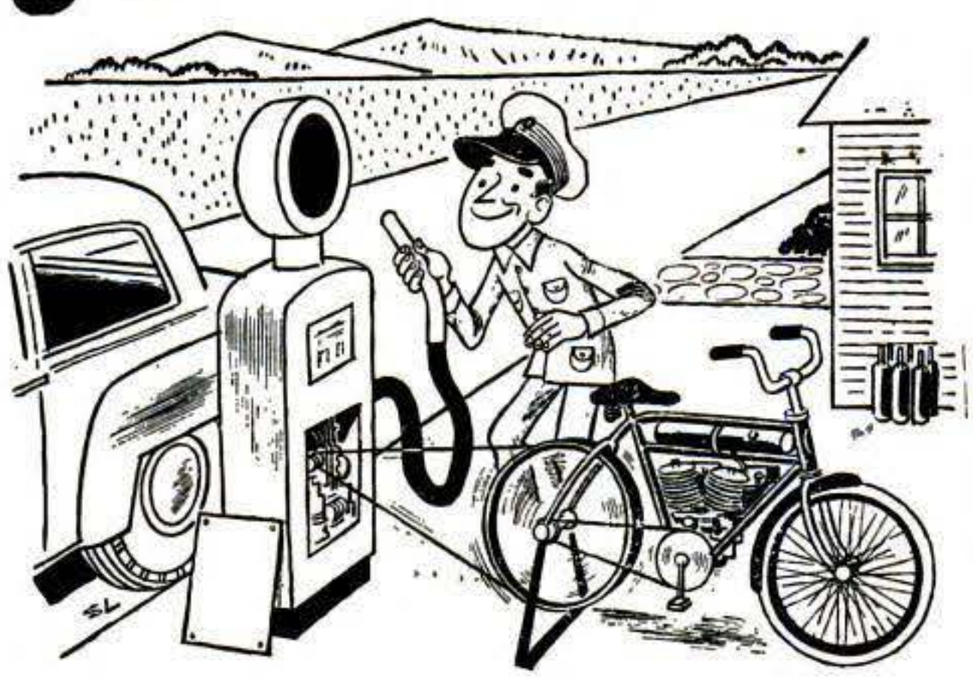
Jets Power One-Man Helicopter

STRAP yourself into this one-seater, fire up the little pulse-jet engines at the ends of the two rotor blades, and you can take off straight up. The tank beneath the seat holds enough fuel—kerosene or Diesel oil—for a 90-minute jaunt. A vertical aluminum tube acts as the airframe of the 'copter, which weighs only 200 pounds empty. Once started, the jets need no auxiliaries; the centrifugal effect of the whirling blades delivers fuel to them. Called the "Buck Private," it was built for the Air Force by the American Helicopter Company.

My Most Ingenious Solution



When I was operating a garage in an isolated section, occasional power failures would stop every gas station for miles around—except mine. How do you think I got power for my gas pumps?

I used my motor bike. When the electricity failed, I would remove the rear tire and run a belt from the pump to the rear wheel. The bike's motor ran the pump and I always did a land-office business at these times.—Henry Josephs, Gardenville, Pa.

Pressure Waistcoat Protects Airmen's Lungs at High Altitudes

WHEN the British jet bomber, the Canberra, recently flew from Ireland to the United States, each of its three crewmen wore an inflated waistcoat to put external pressure on his lungs. This prevented injuries at high altitude.

The experimental waistcoats, similar to the G-suit that protects U. S. airmen, was necessary because the Canberra flew above 40,000 feet. They are worn under the regular Mae West life jacket. The Canberra's was the first non-stop jet-airplane flight between Europe and the United States.

Water Ballast Steadies Boat

ADD a brace of keels to an inflatable plastic boat, and you have a lightweight craft that's hard to tip even in heavy surf.

In this case, water does the work. Under the four tubular air chambers are two pontoons, one on each side, filled with water. When the craft tips, the weight of the water on the raised side helps keep it upright. It's made by Bilnor Corp., Maspeth, N. Y.

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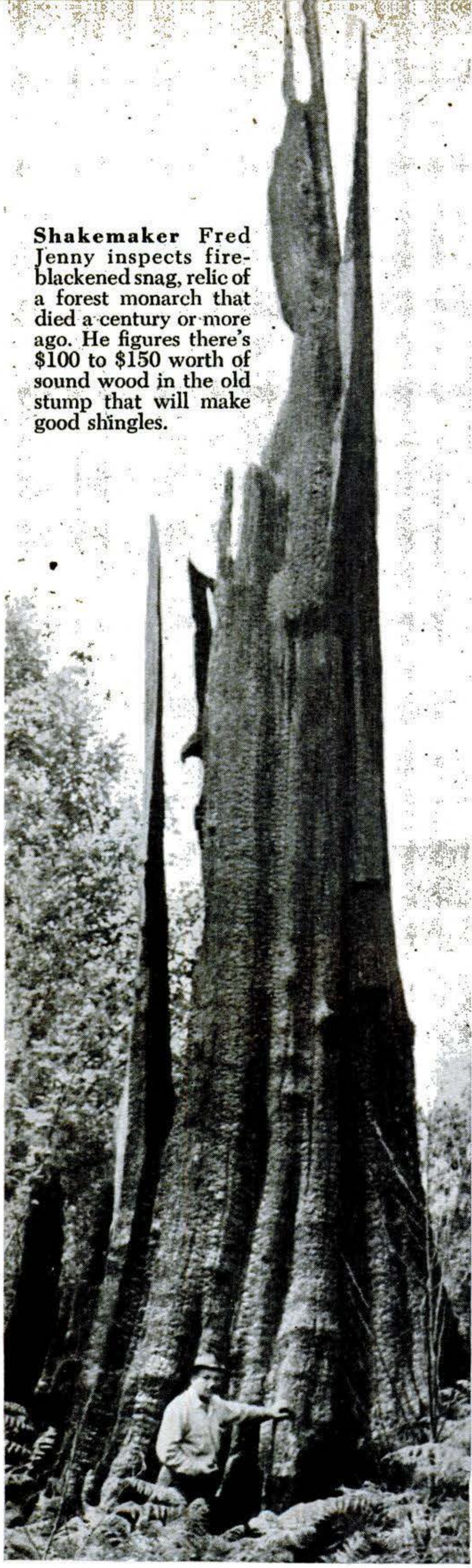


Shakemaker Fred Jenny inspects fire-blackened snag, relic of a forest monarch that died a century or more ago. He figures there's $100 to $150 worth of sound wood in the old stump that will make good shingles.

Shingles Fly From Stumps

FRED JENNY rives shakes with a frow and a maul. Which is a lumberman's way of saying he splits out cedar shingles with an L-shaped knife and a wooden mallet.

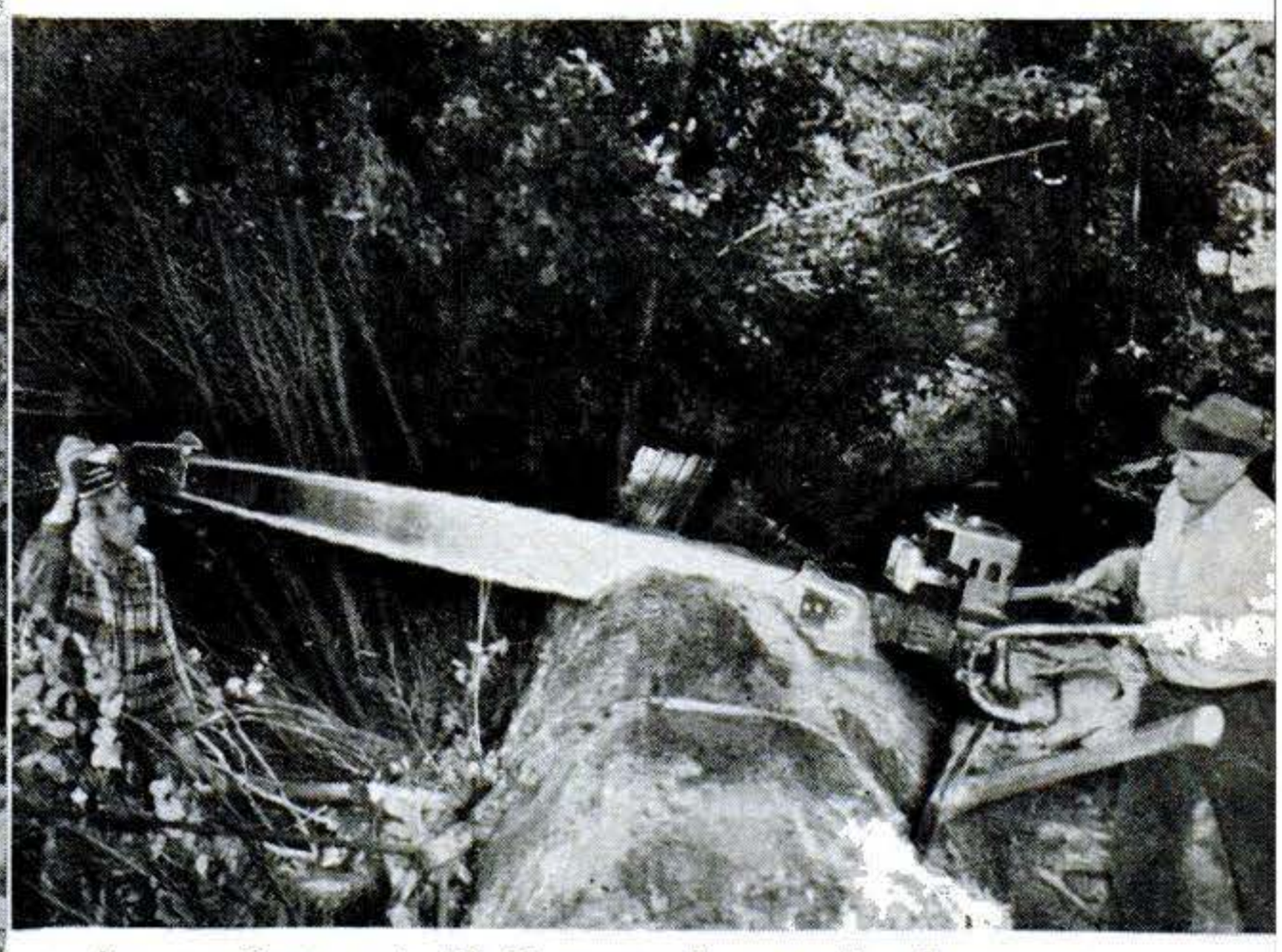
Jenny and his partner, Amund Kjelstad, work the cut-over timber of Snohomish County, Washington, on the western slope of the Cascade Mountains.

Actually, they rive other stuff besides shakes. They also split straights and boards. Straights are shingles that aren't tapered. Boards are shake-length—about 26 inches—but thick enough for two shingles; they're sent down to mills for more precise riving.

All this is important economically these days for two reasons:

First, red cedar is in high demand as modern-styled, long-lasting roofing—cedar men will tell you it lasts "one year longer than concrete." Second, Jenny and Kjelstad cut their shakes from snags, stumps, and fallen trees that otherwise would go to waste in the thrice-logged woods.

Besides helping to stretch the nation's short supply of lumber, their work clears the forest of a fire hazard.



An ancient windfall, passed over by loggers, is cut into 26-inch bolts with chain saw by Jenny and his partner, Amund Kjelstad. Bolts will be split into lengths about a foot square.

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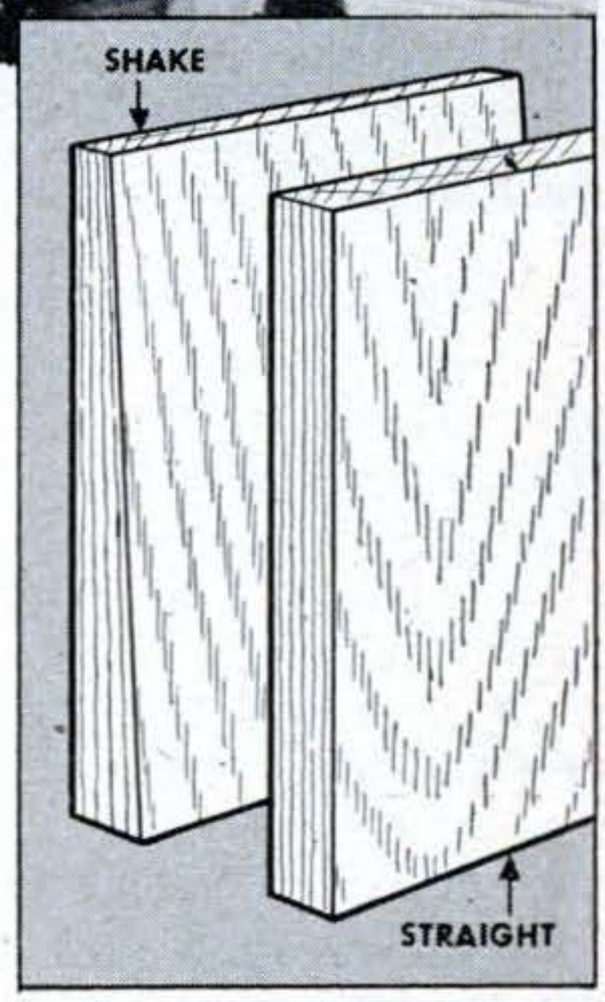
Whamming an L-shaped cutting tool, called a frow, with a broad-faced cherry-wood maul, Jenny splits blocks into shakes, and straights. For shakes, he slants frow so line of splitting will produce taper.

Shake factory: While Jenny rives out a wide one, Kjelstad trims shingles with a hand ax and packs them into bundles between two slats held by metal straps. Surveys show that 210 million cu. ft. of such leftover wood are wasted every year in Washington alone.



Drawing at right shows the difference between a shake and a straight. The shake is tapered at one end so it can be overlapped by the thick end of another shingle without producing marked unevenness at the joint. The straight is untapered.

Several days' output of red-cedar shakes, stacked on homemade trailer, is hauled out to the highway behind tractor that Kjelstad also uses for bulldozing stumps and snaking logs. Each bundle contains about 50 shakes, depending on their width. Four bundles make a square —standard measurement of roofing industry. Two men may turn out five squares a day.

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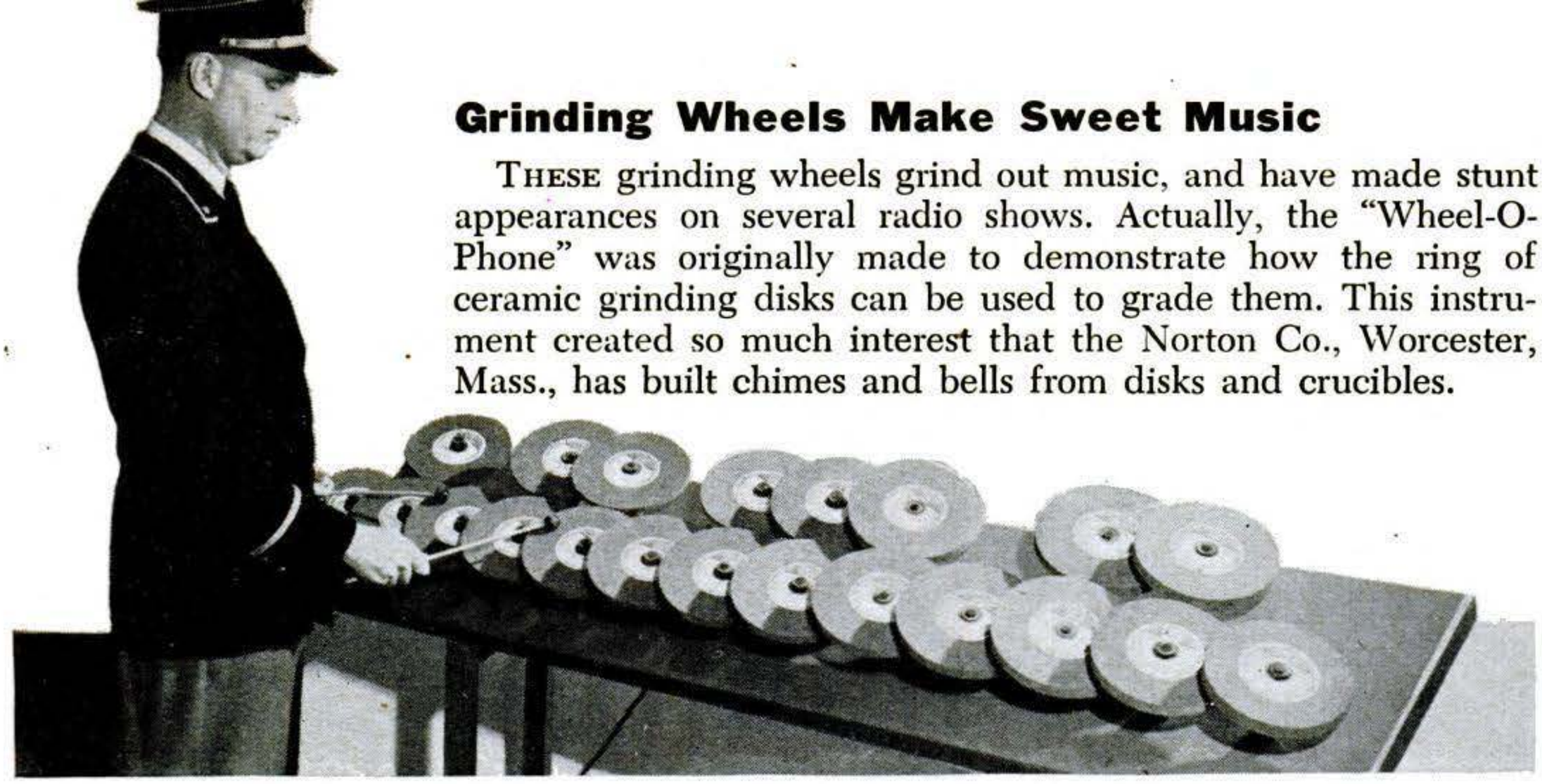
Grinding Wheels Make Sweet Music

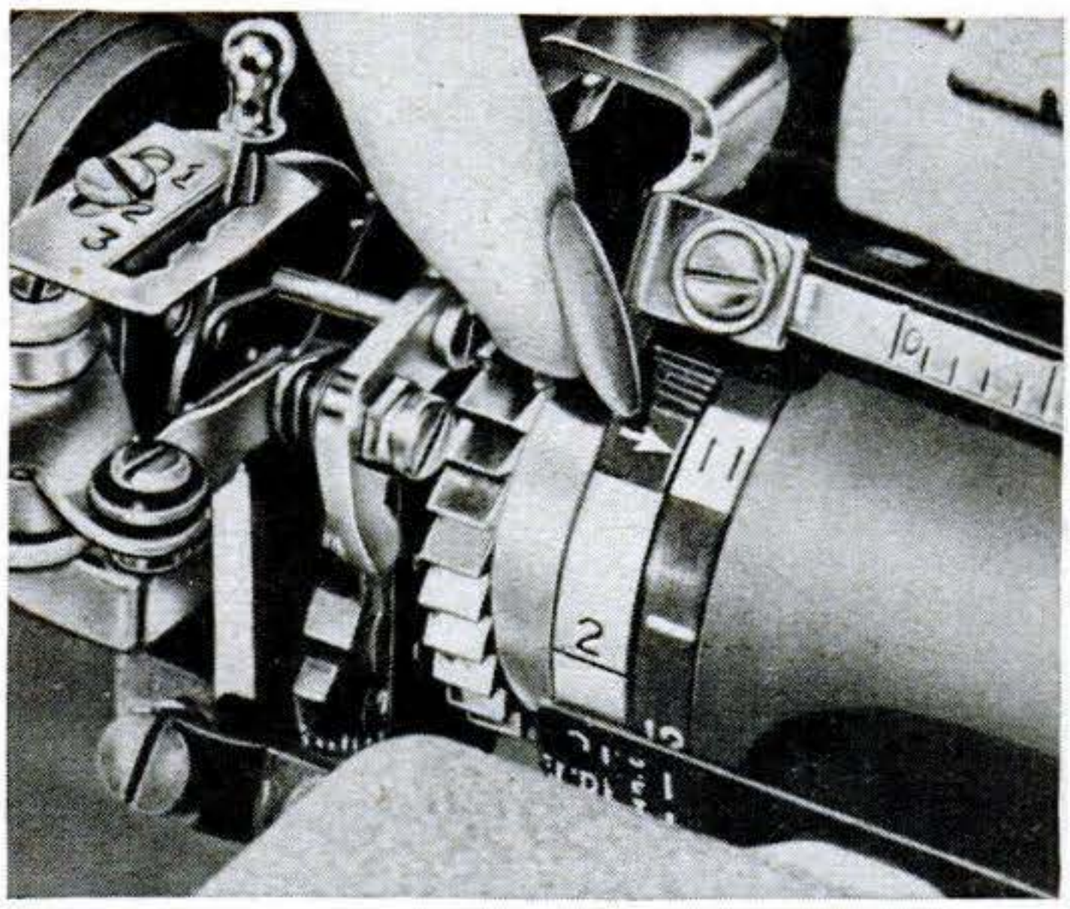
THESE grinding wheels grind out music, and have made stunt appearances on several radio shows. Actually, the "Wheel-O-Phone" was originally made to demonstrate how the ring of ceramic grinding disks can be used to grade them. This instrument created so much interest that the Norton Co., Worcester, Mass., has built chimes and bells from disks and crucibles.

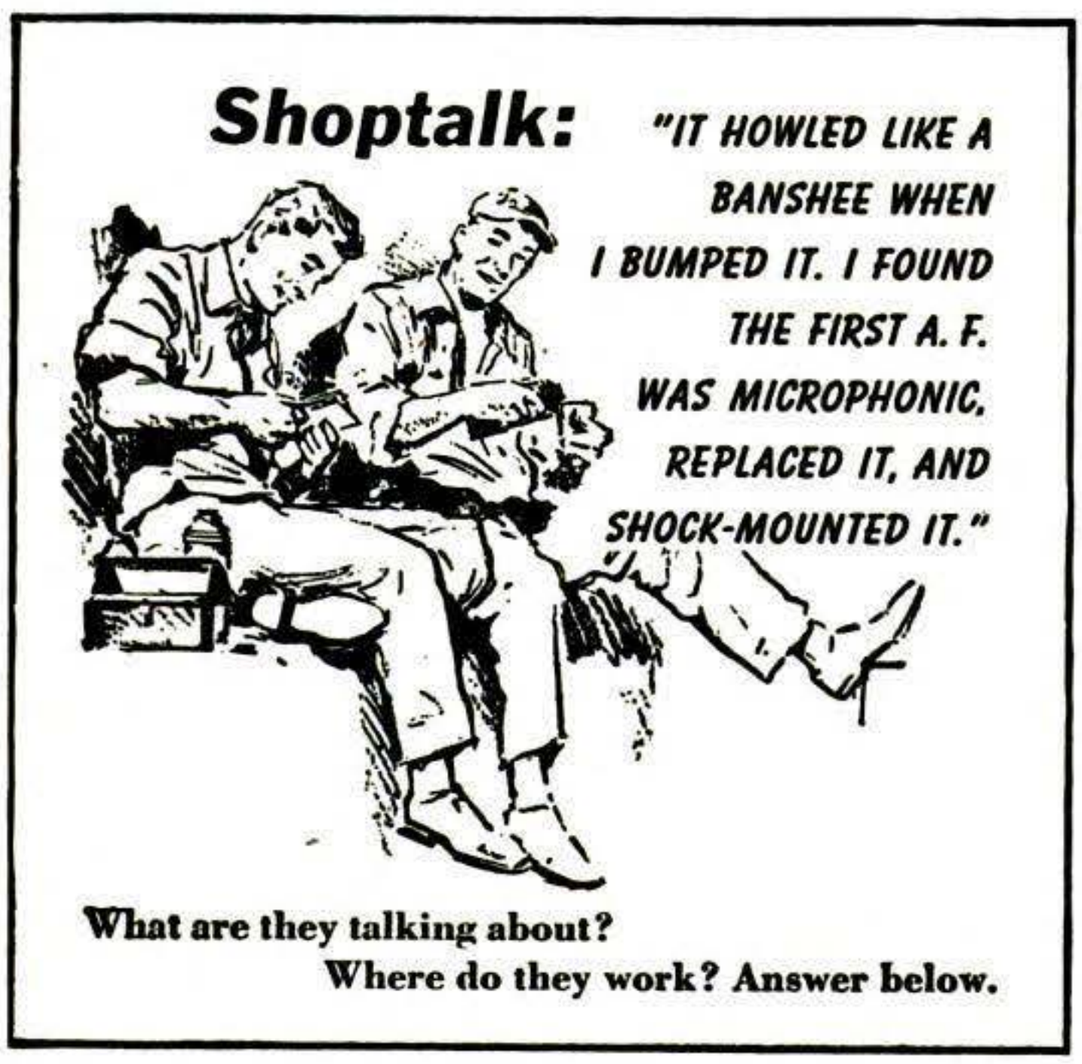


Typing Scale Warns of Page Bottom

YOU won't type off the bottom of the page on typewriters equipped with a new gadget. The "Page Gage" on the latest Smith-Corona machines tells you when you near the bottom edge and then indicates how much room is left.

It consists of two graduated scales at the left end of the roller. To set it, you line up the arrow on one scale with the number on the other scale that corresponds to your paper's length in inches. The outer scale flashes red when you have only 2½ inches left. As you type after the warning, its graduations show how many inches are remaining.

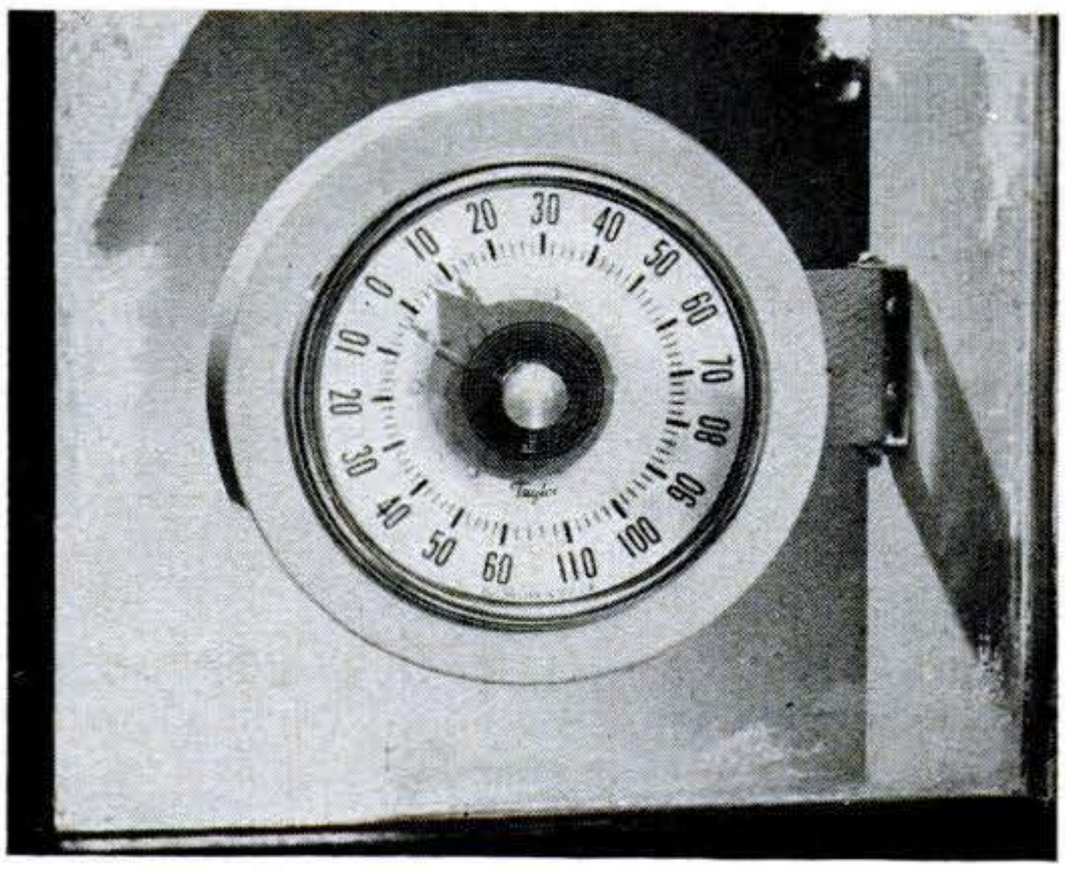




They are radio technicians. The first audio frequency amplifier tube (a.f.) was sensitive to mechanical vibrations and tended to pick up strong vibrations from the speaker and reamplify them (microphonic). A new tube cured this condition. Shock mounting (placing the tube socket on rubber cushions) kept the trouble from recurring.

Dial Shows Temperature Extremes

THERE are three pointers on the dial of this outside-the-window thermometer. They tell you not only the present temperature, but also the coldest and hottest readings since the last time you reset them. Manufactured by the Taylor Instrument Companies, the thermometer has a translucent back to make the scale easier to read.



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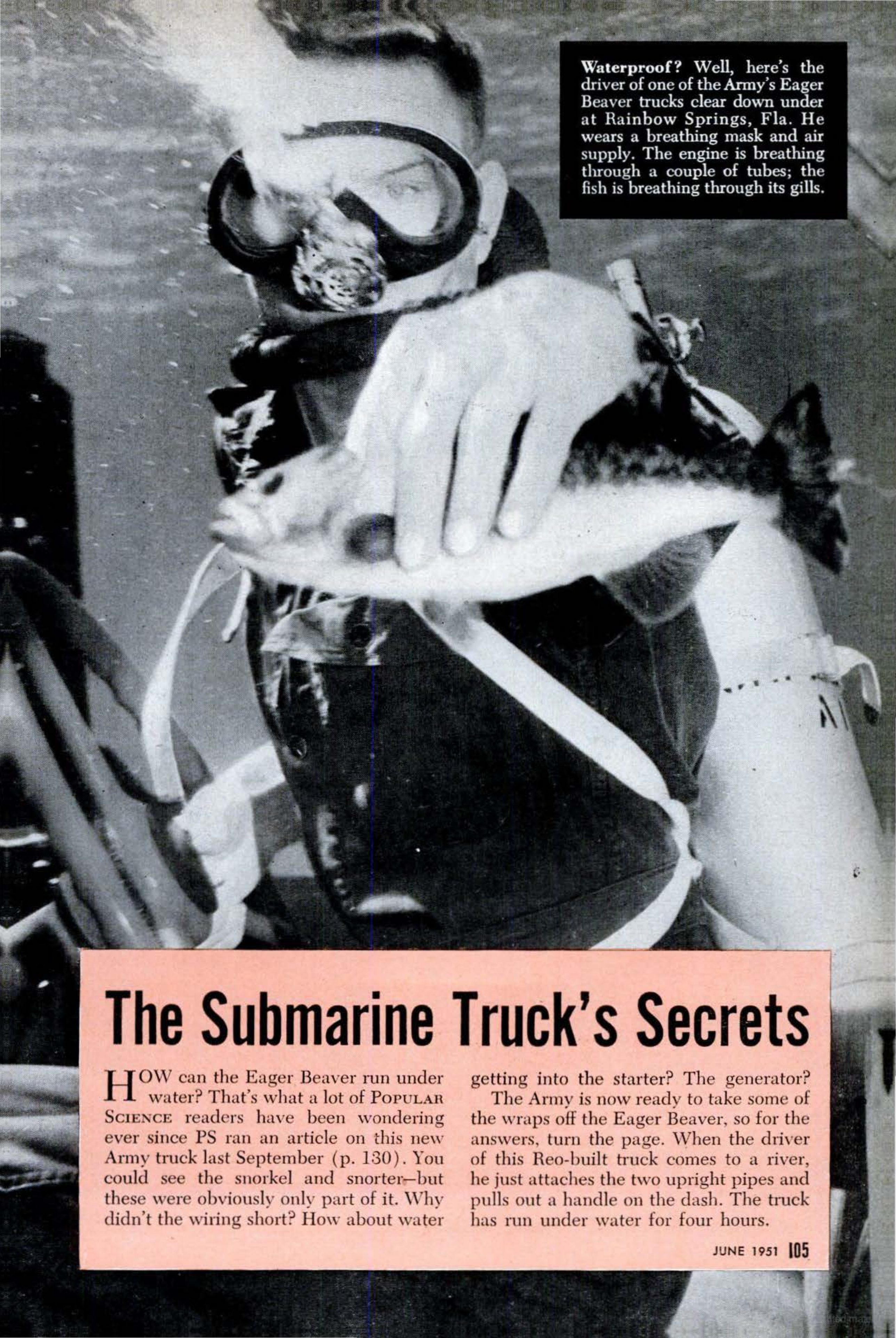
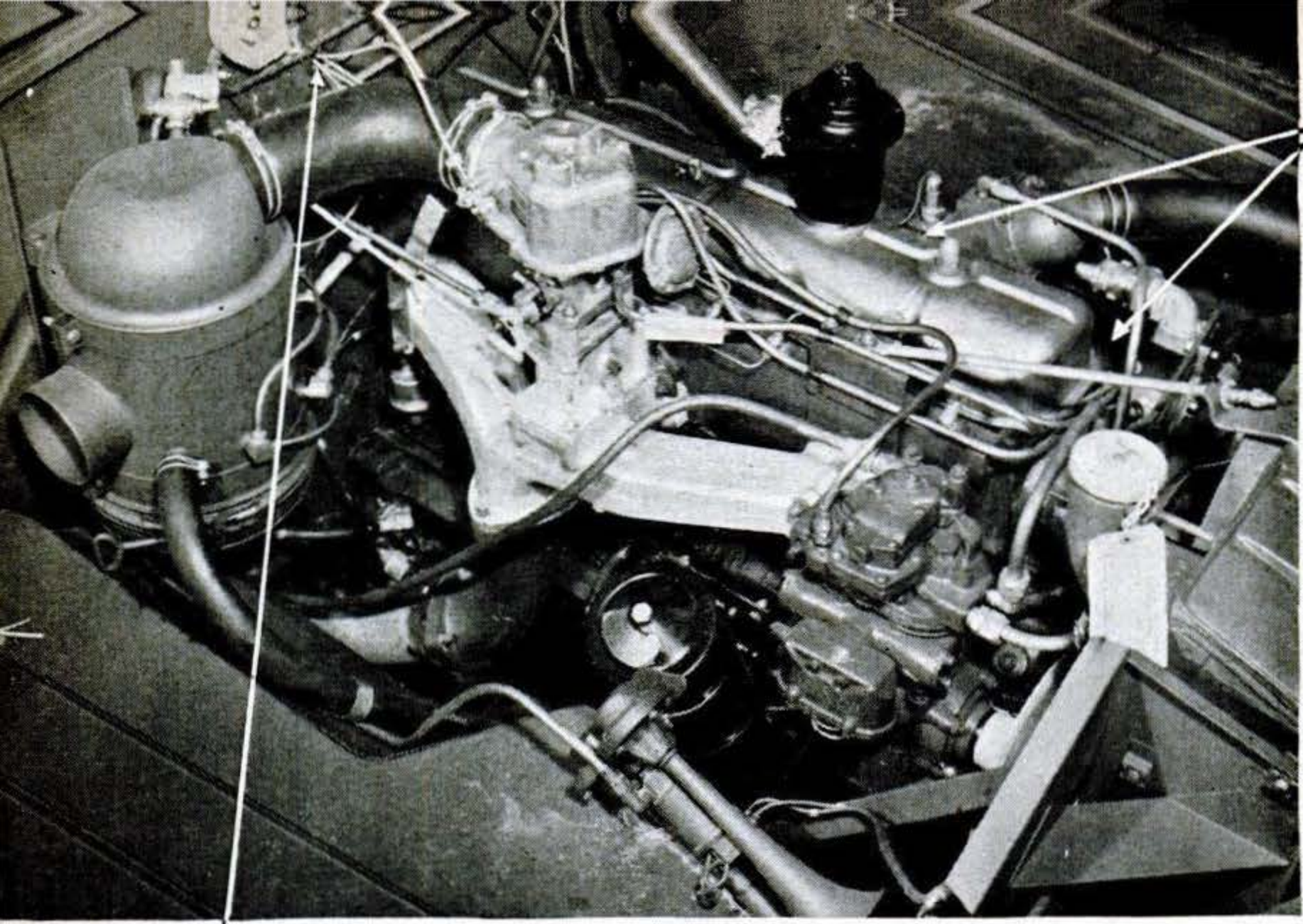


Waterproof? Well, here's the driver of one of the Army's Eager Beaver trucks clear down under at Rainbow Springs, Fla. He wears a breathing mask and air supply. The engine is breathing through a couple of tubes; the fish is breathing through its gills.

The Submarine Truck's Secrets

HOW can the Eager Beaver run under water? That's what a lot of POPULAR SCIENCE readers have been wondering ever since PS ran an article on this new Army truck last September (p. 130). You could see the snorkel and snorter—but these were obviously only part of it. Why didn't the wiring short? How about water getting into the starter? The generator?

The Army is now ready to take some of the wraps off the Eager Beaver, so for the answers, turn the page. When the driver of this Reo-built truck comes to a river, he just attaches the two upright pipes and pulls out a handle on the dash. The truck has run under water for four hours.



RADIO SUPPRESSION BUILT INTO EACH COMPONENT

DASH CONTROL CLOSES VALVES THAT SHUT OFF VENTILATION TO DISTRIBUTOR, CRANKCASE, AND INTAKE MANIFOLD

BUZZER, HORN, SPEEDOMETER AND ALL DASH INSTRUMENTS HERMETICALLY SEALED

WARNING BUZZER SIGNALS LOWERED AIR-BRAKE PRESSURE, OPERATES EVEN UNDER WATER

ALL WOOD, CANVAS, AND UPHOLSTERY SEALED, PRIMED, AND PAINTED

EXPOSED METAL PARTS TREATED, PRIMED, AND PAINTED AGAINST CORROSION

SHEET METAL TREATED TO RETARD RUST

CAB FLOOR COATED WITH CARBORUNDUM TO GIVE FOOTING WHEN WET

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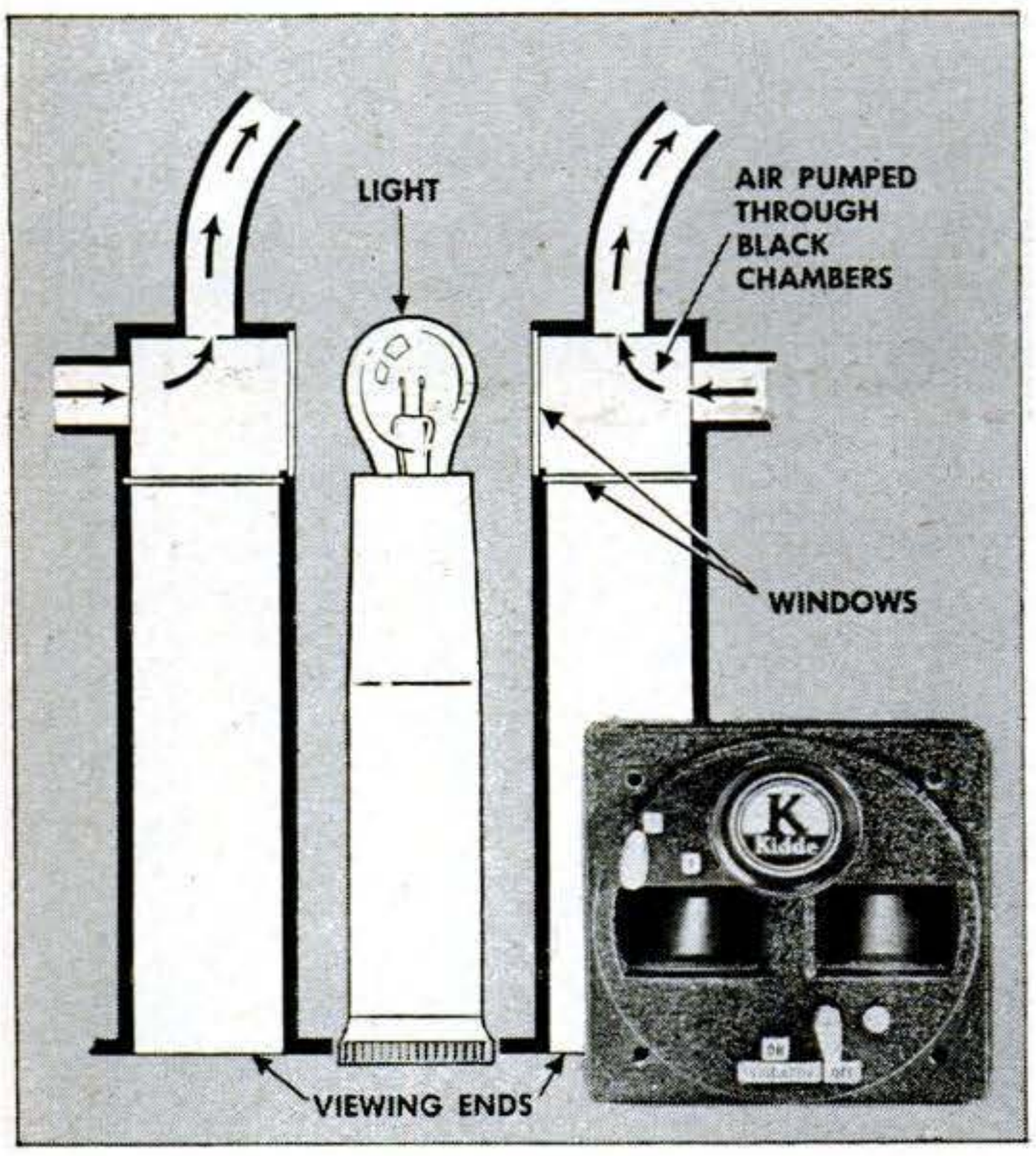
New Bridge Built on Old Piers Saves Taxpayers Money

THE usual trouble—money—held up replacement of a rickety bridge across the Holston River, near Knoxville, Tenn., until a sharp-eyed engineer noticed that the old supporting piers still looked good. Inspection revealed that the hand-cut limestone, set 45 years ago, was actually in perfect condition. Encasing the piers in concrete to carry the new bridge saved enough money to make the job possible.



Human Eye Outdoes Photocell

THIS smoke detector for airplanes is almost foolproof. False alarms, frequent with delicate photocell detectors, are eliminated by having the pilot watch air from his plane's cargo compartments pass through small black chambers lighted by an auto headlamp bulb. Clean air will reflect no light, and the pilot sees nothing. But smoke will reflect light, and the pilot sees bright streaks. Walter Kidde & Co. makes it.

Walkie-Lookie Is One-Man TV Station

HERE'S the "walkie-lookie"—a portable television station for industrial use. RCA's tiny Vidicon camera (PS, May '50, p. 119) now has a back-pack power supply and transmitter that enables it to send pictures up to a mile. Besides transmitting pictures, it receives synchronizing pulses for the camera and voice instructions for the cameraman. Previously, TV cameras had to be connected to control units by wire.

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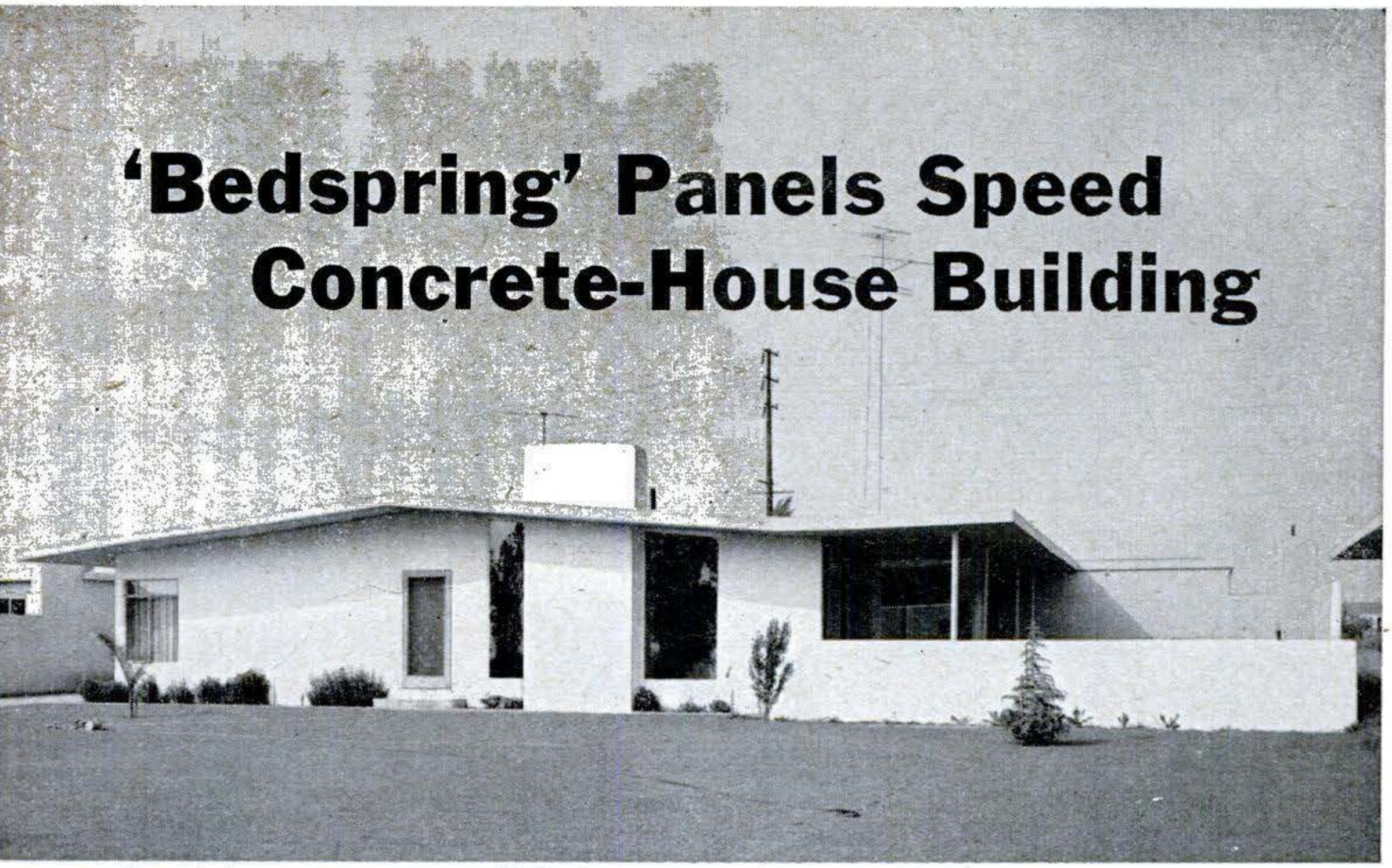
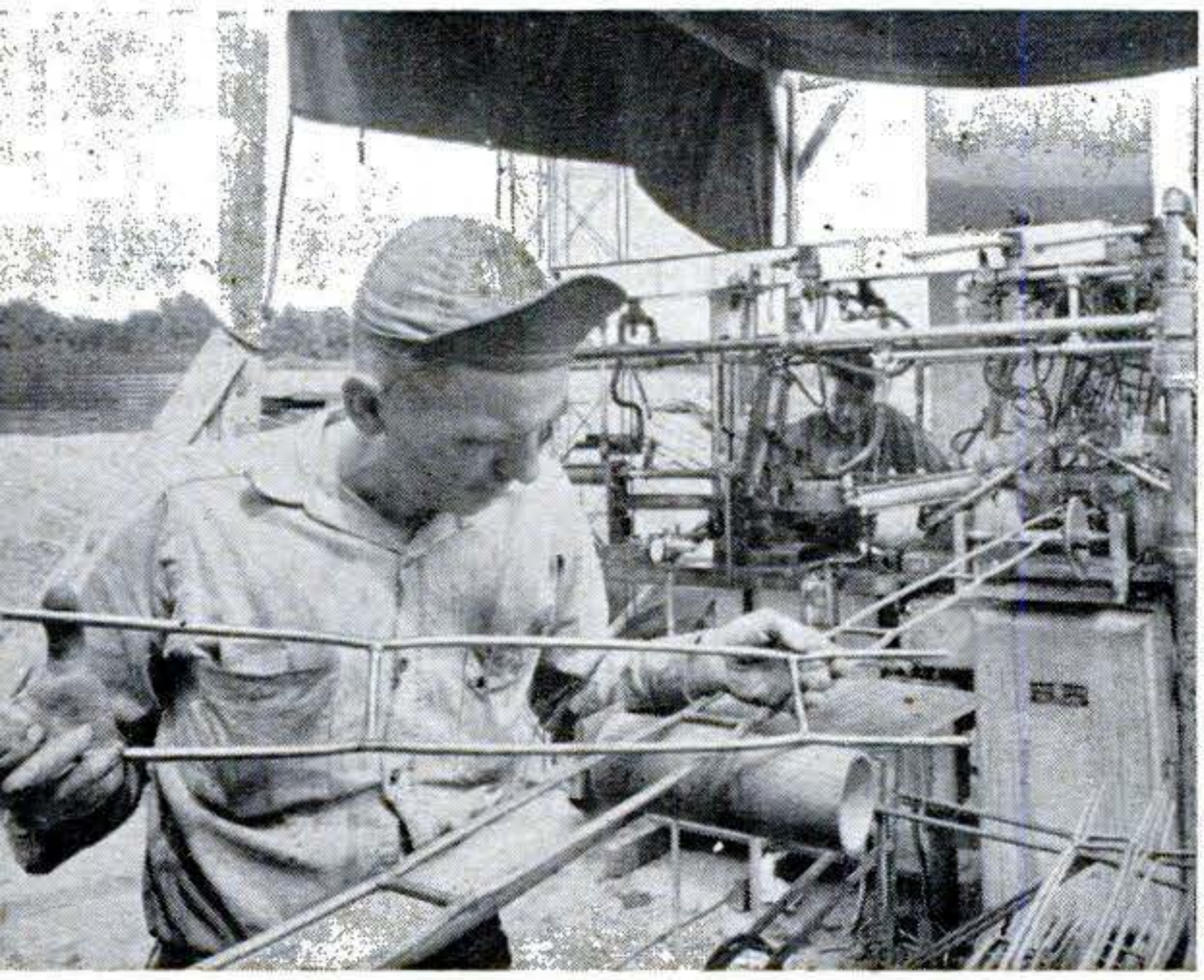
'Bedspring' Panels Speed Concrete-House Building



In this house, even patio wall, barbecue pit, and fireplace are made with "bedspring" panels.



A workman checks welds on one of seven horizontal units that make up a completed panel. Vertical rods will be welded to this unit alongside 3-in. struts visible above.

CALIFORNIANS, always eager to try out new ways of building and designing homes, are now using another unusual technique. They're making walls and roofs of steel "bedspring" panels, cardboard cartons, and sprayed-on, lightweight concrete. The result is a handsome house that goes up in half the time required by ordinary methods and has its own built-in insulation. Cost is about the same as standard frame construction.

Under the hot California sun, these houses are claimed to be 20° cooler than equivalent frame or stucco buildings. The heat protection comes partly from the insulating value of the lightweight concrete and partly from the hollow construction of the walls and roof. This is the purpose of the cardboard cartons. They are slipped inside the steel reinforcing panels to create dead-air spaces that serve as insulation. The cartons also make a backing against which to spray the concrete. The spaces between cartons fill solidly with concrete, forming columns that carry most of the load.

The bedspring reinforcing panels are prefabricated on semi-automatic machines from ⅜-inch "pencil" steel by the Steel Building Units Corp. One machine cuts, straightens, and welds the rod into horizontal reinforcing units that look like narrow ladders. These units are then assembled into the bedsprings by welding them to vertical rods.

The bedspring houses are being built by a group headed by Jack W. Morris, of Whittier, Calif. To see just how they do it, turn the page.

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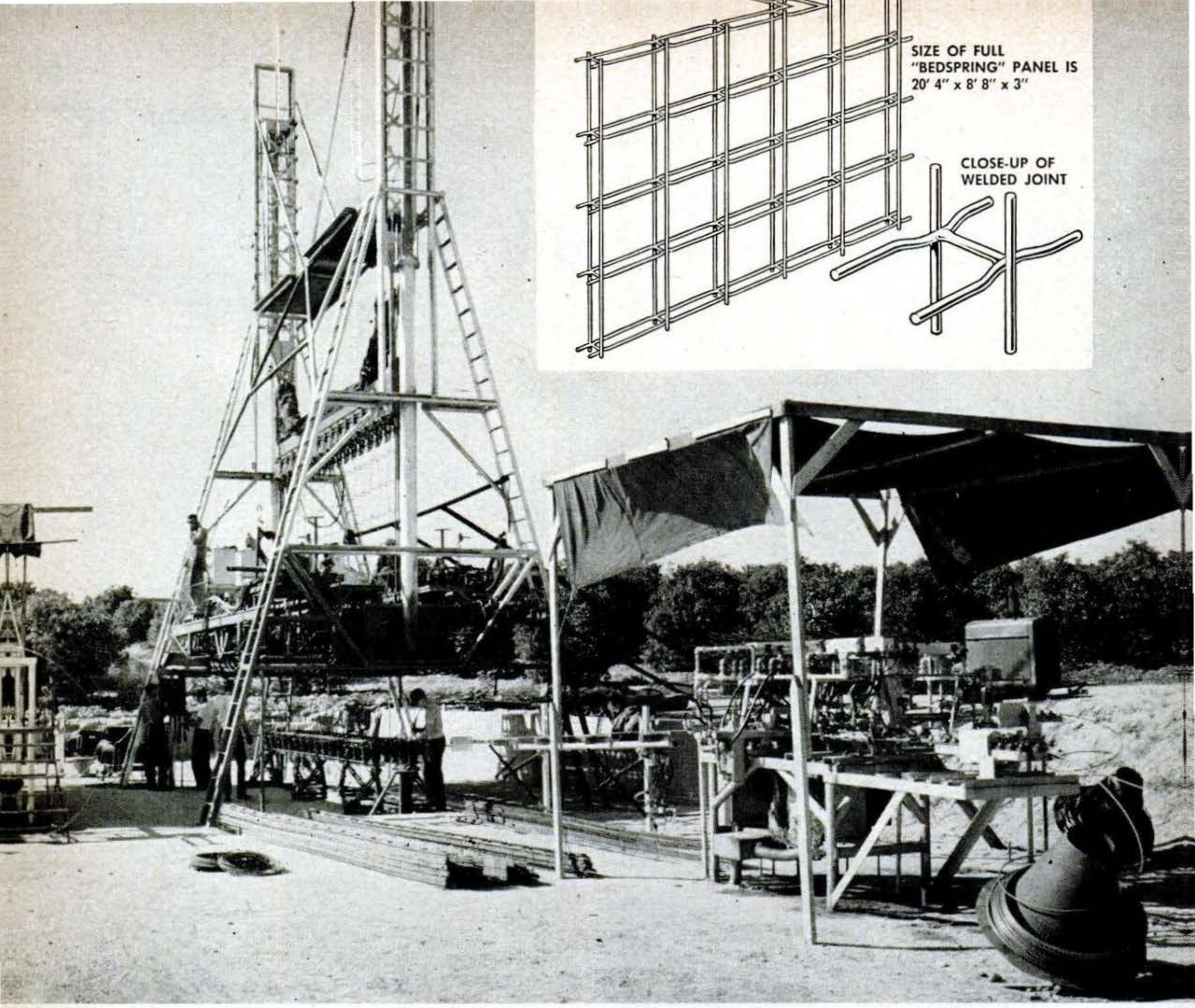
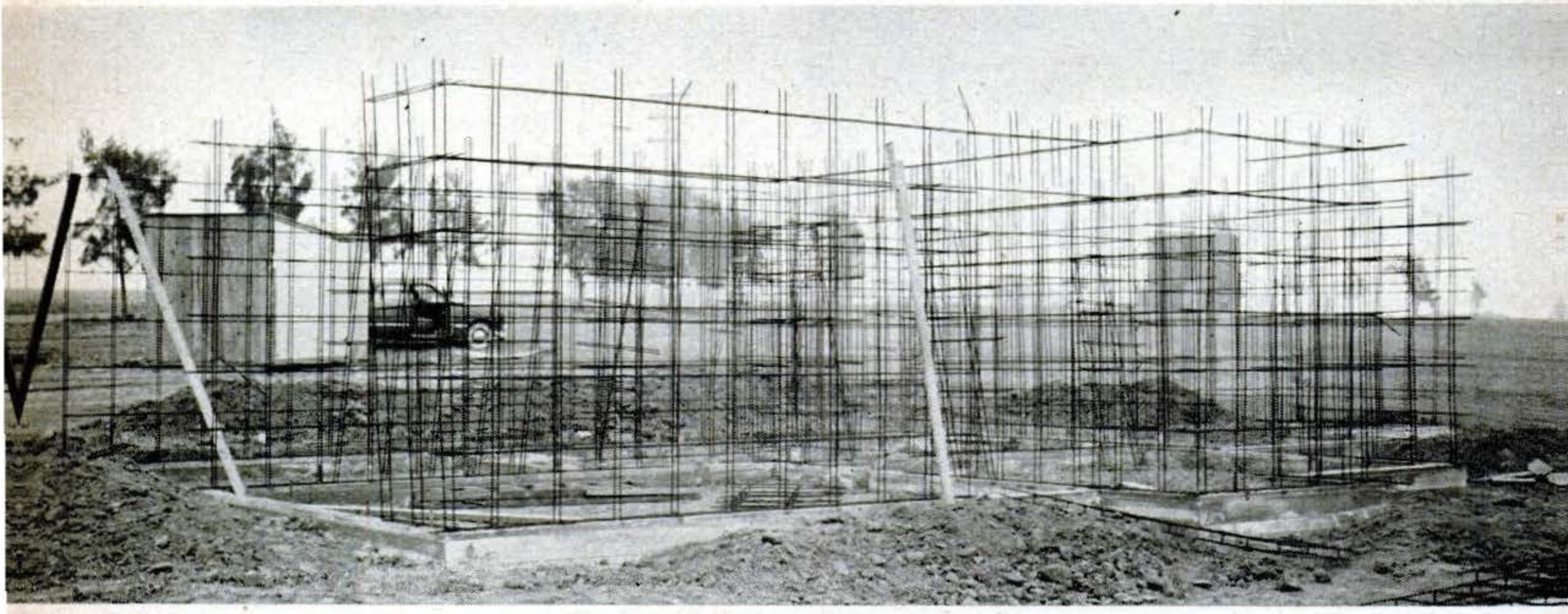


1 Pencil steel on spools (far right) is made into horizontal units by machine at right (finished units are stacked in center foreground). These are assembled with vertical rods into complete panels that rise up in A frame at left. Inset shows details of panel construction.



2 In framing the house, pencil-steel panels are welded to bolts set in concrete-slab foundation. The frame has no openings for windows or doors. These are cut out with a torch wherever they are wanted after the frame is up but before the cardboard boxes are put into place.

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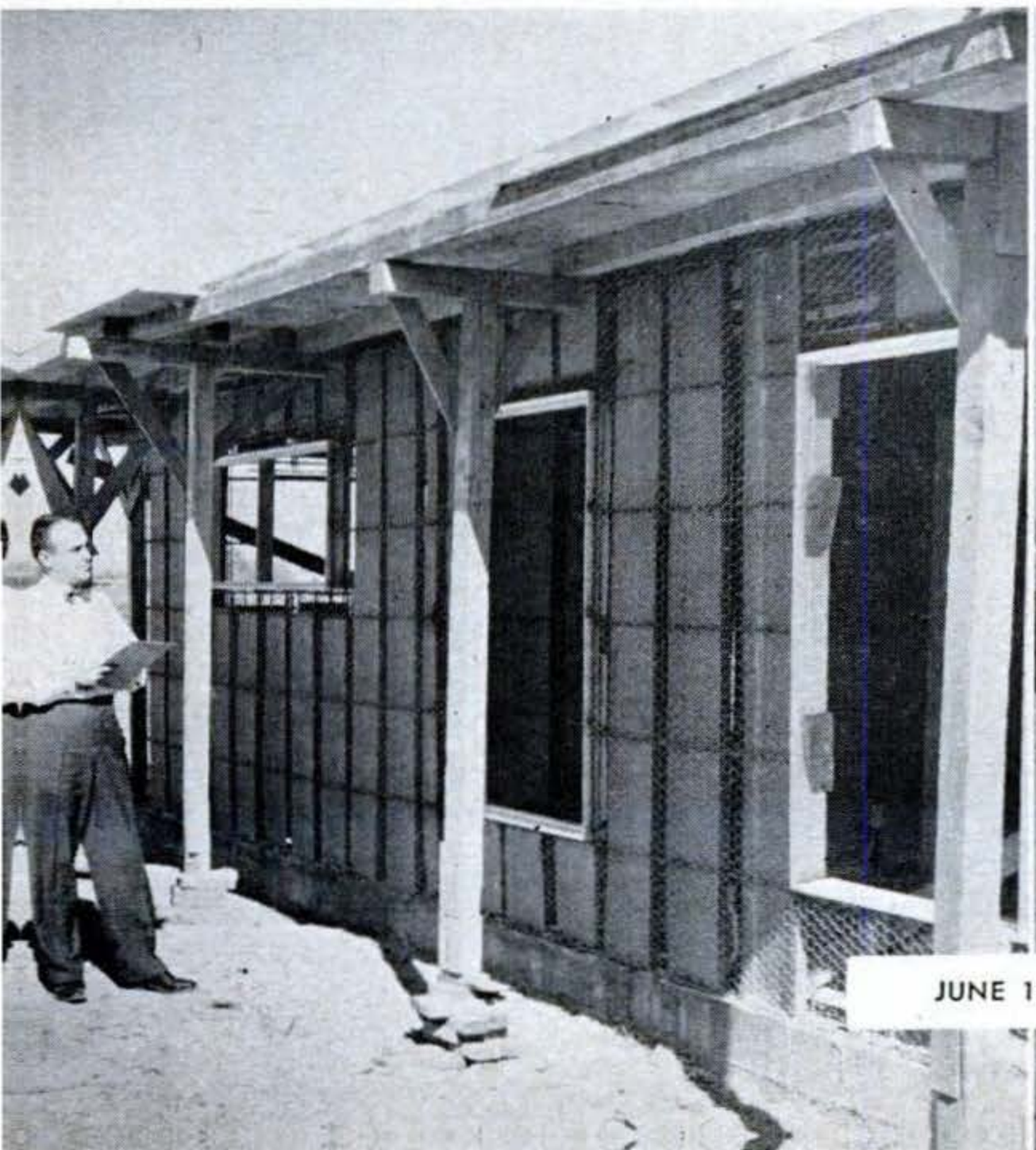
3 **The cardboard cartons** fit between the vertical rods inside panels. Made especially for this purpose of waxed material, they form insulating air spaces inside walls and roof and also provide a backing for sprayed-on concrete. The vertical spaces between cartons are filled with solid concrete that forms columns to help support roof and wide eaves.

4 **With wire lath** spread over the panels to prevent cracking, the walls are now ready to be sprayed with concrete. Temporary shoring supports roof, which has already been concreted.

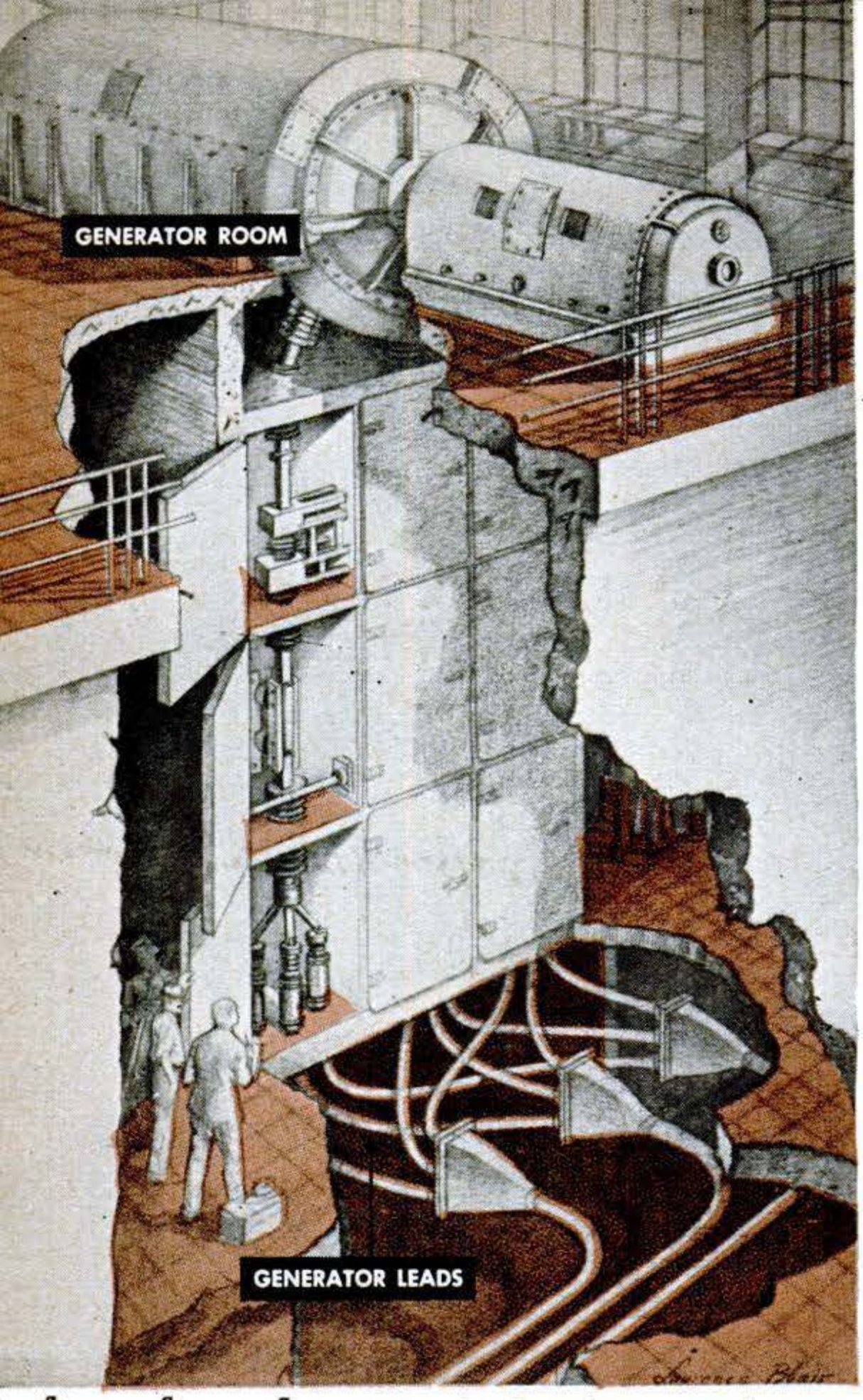
5 **Premixed concrete** is sprayed on through a hose by the Gunite method and then smoothed. The same technique is used for both 6-inch roof (below) and 5-inch walls.

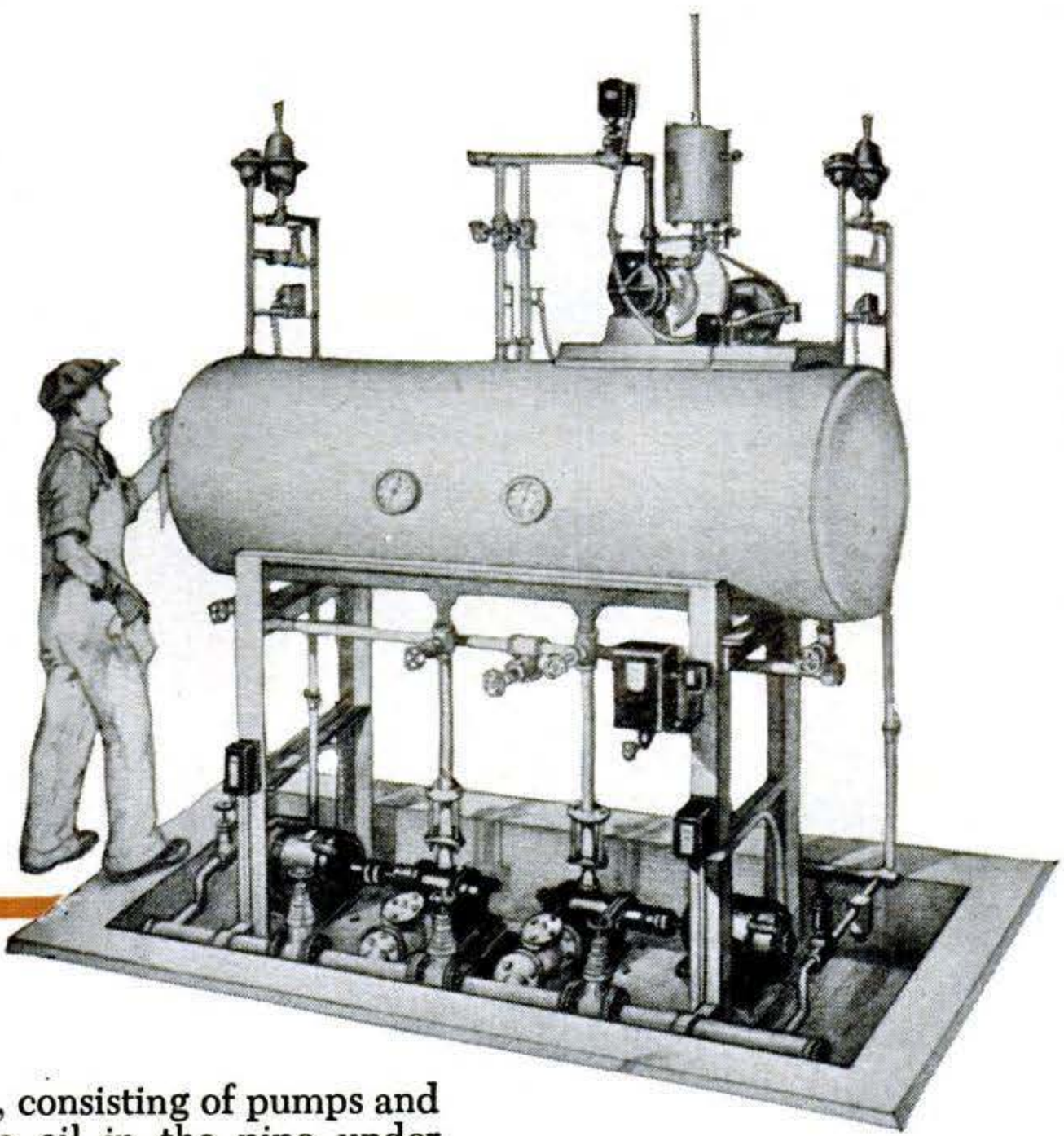


Piping High

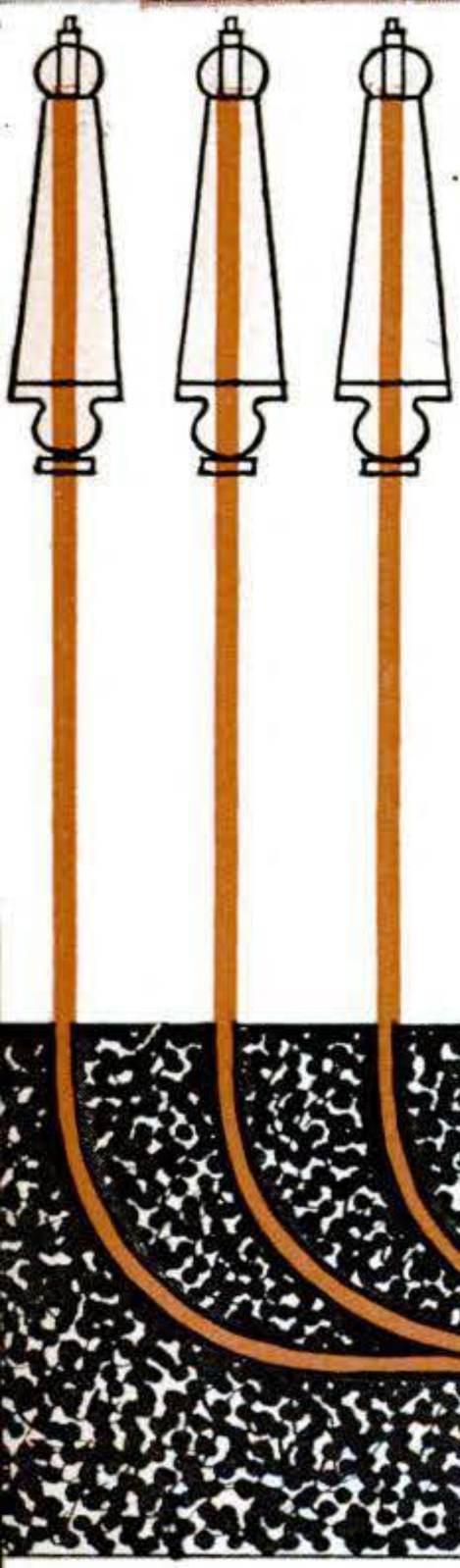
HAVE you ever wondered how cables carrying many thousands of volts are snaked safely through a big city? High lines, such as used in the open country, are out of the question. The high-voltage lines must go underground.

This problem confronted Consolidated Edison engineers when they recently decided to link up major New York City powerhouses and sub-stations with 138,000-volt tie lines. They solved it by running their "hot" cables through underground steel pipes filled with oil at a pressure of 200 pounds per square inch. The high-pressure



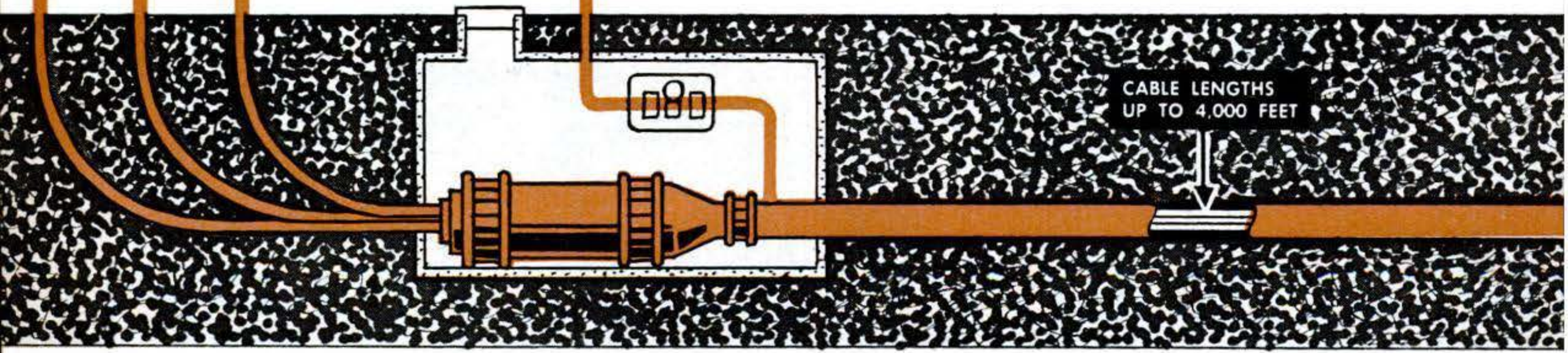


The high-voltage conductors used in conventional three-phase power system leave the powerhouse encased in a steel pipe filled with oil under a pressure of 200 p.s.i. The oil serves as a coolant as well as added electrical insulation.



OIL LEAD FROM PUMPING PLANT

Automatic equipment, consisting of pumps and oil reservoir, keeps the oil in the pipe under constant pressure regardless of expansion or contraction of conductors or pipe.



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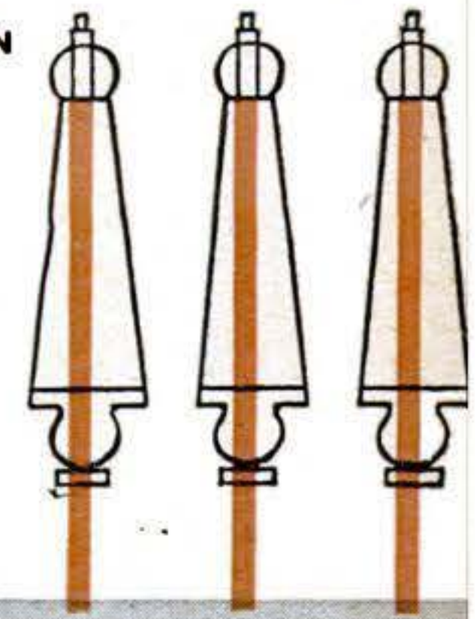
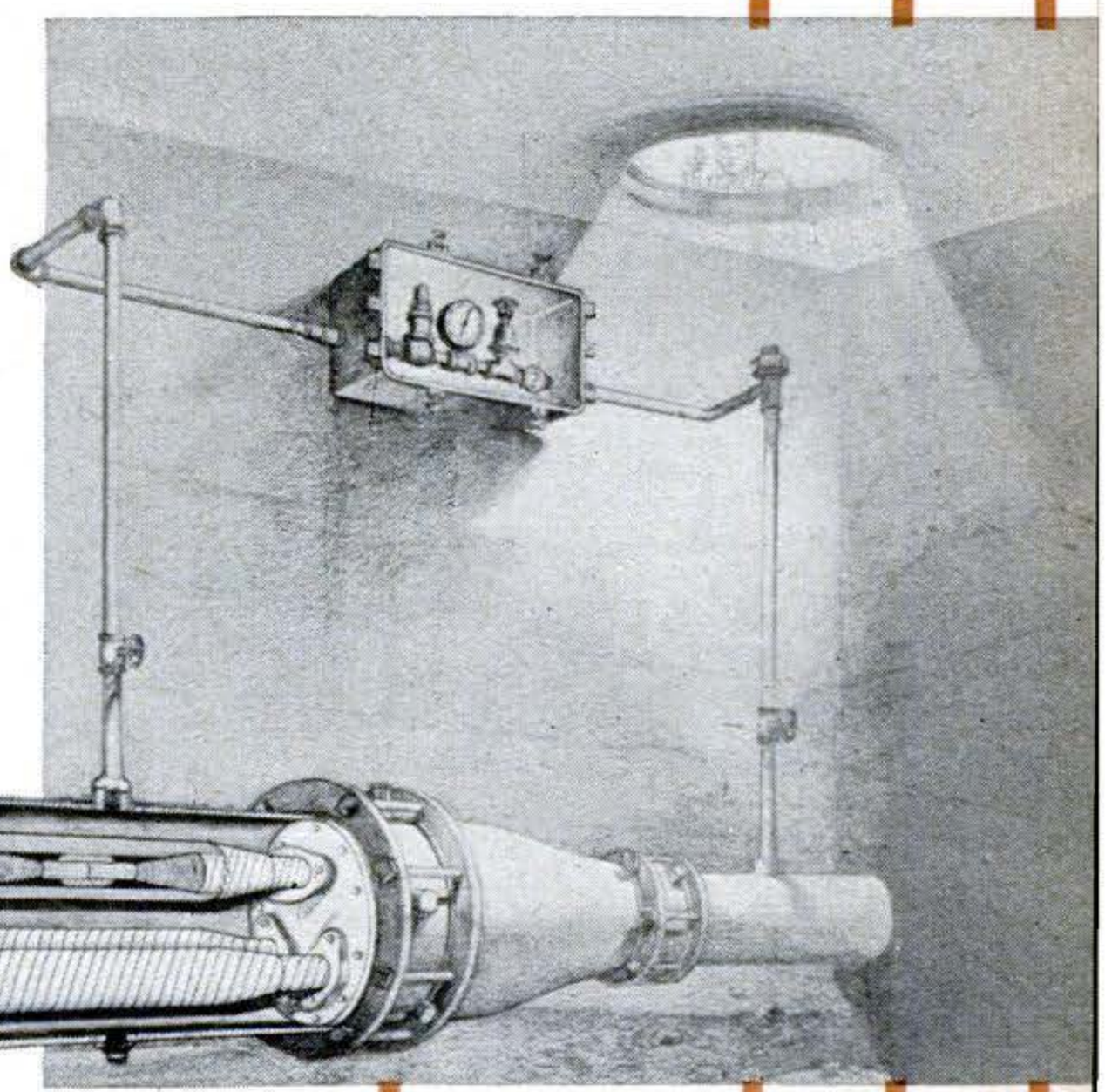
Voltage in Oil

oil not only increases the insulating qualities of the many layers of oil-impregnated paper encasing the cables, but it also keeps the conductors down to 158° F. even while carrying high loads.

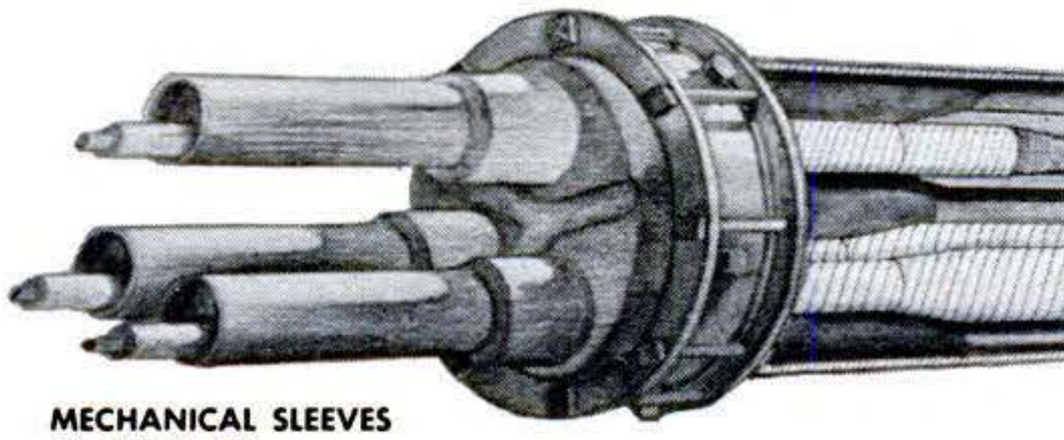
The system, pioneered by the Okonite-Callender Co., of New Jersey, and in use on many miles of the nation's electrical network as well as at TVA's Wilson and Kentucky Dams, not only eliminates costly underground conduit construction, but is easily maintained and allows tremendous loads to be transmitted safely and efficiently at high voltages. END



Drawing at right shows how the oil system extends all the way to the big porcelain terminal insulators (utilities men call them "potheads"), also filled with oil under pressure.



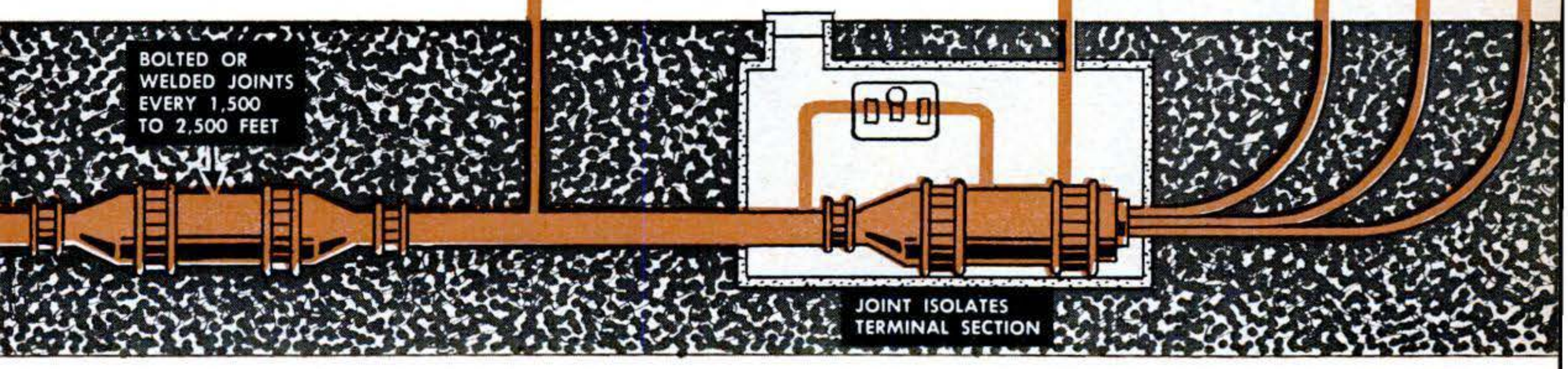
To reduce possible damage caused by oil leaks, pipe is sealed off where splices or connections are made. Oil for splice chamber by-passes through valve system that automatically cuts flow to it if a leak develops.



MECHANICAL SLEEVES IN PLACE OF SWEATED CONNECTORS

INSULATED STRANDED CONDUCTORS IN WELDED-STEEL PIPE

The three stranded conductors, each insulated with layers of oil-impregnated paper protected by a metal shield, are encased in an oil-filled steel pipe protected by a special corrosion-resistant coating.



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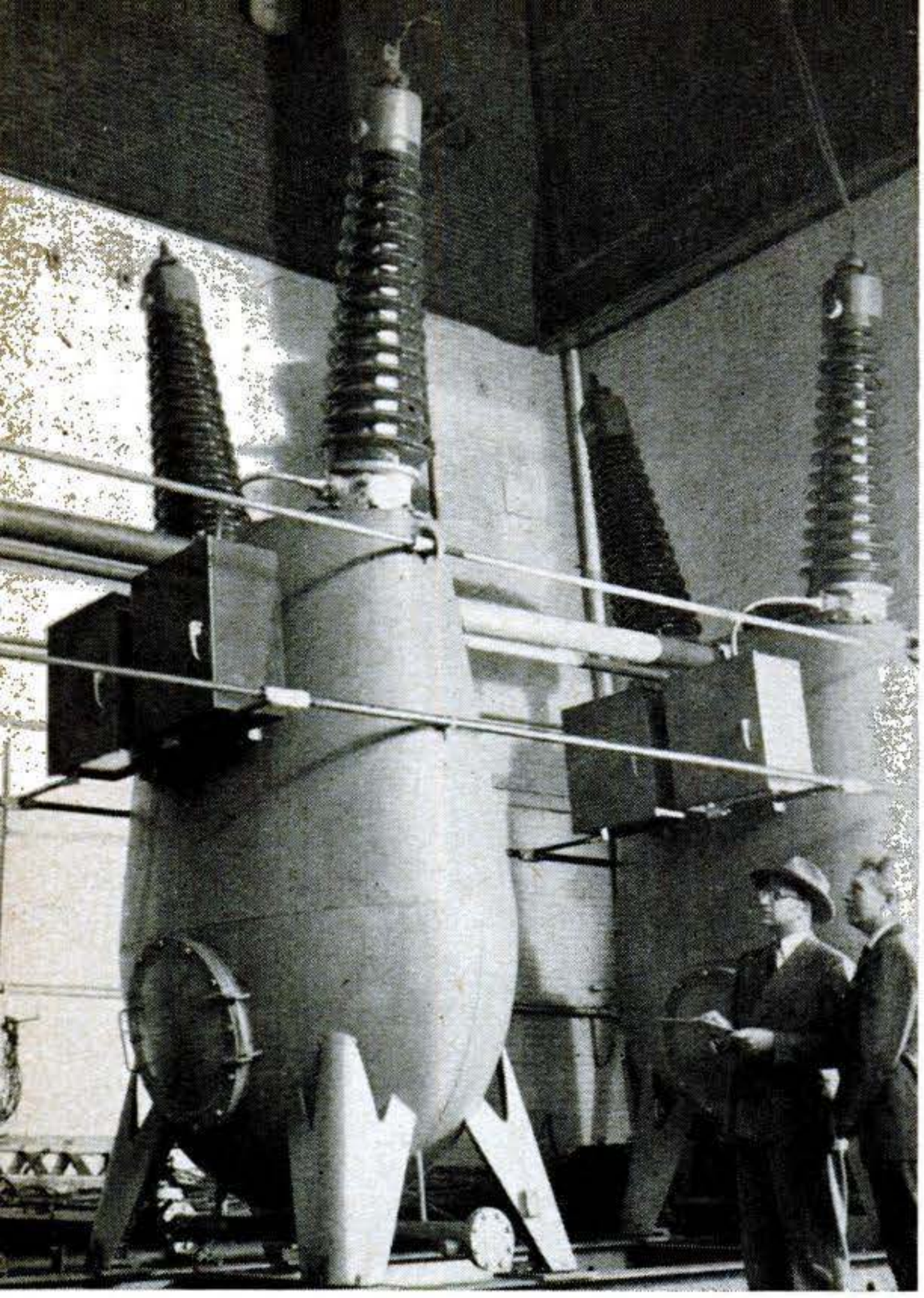
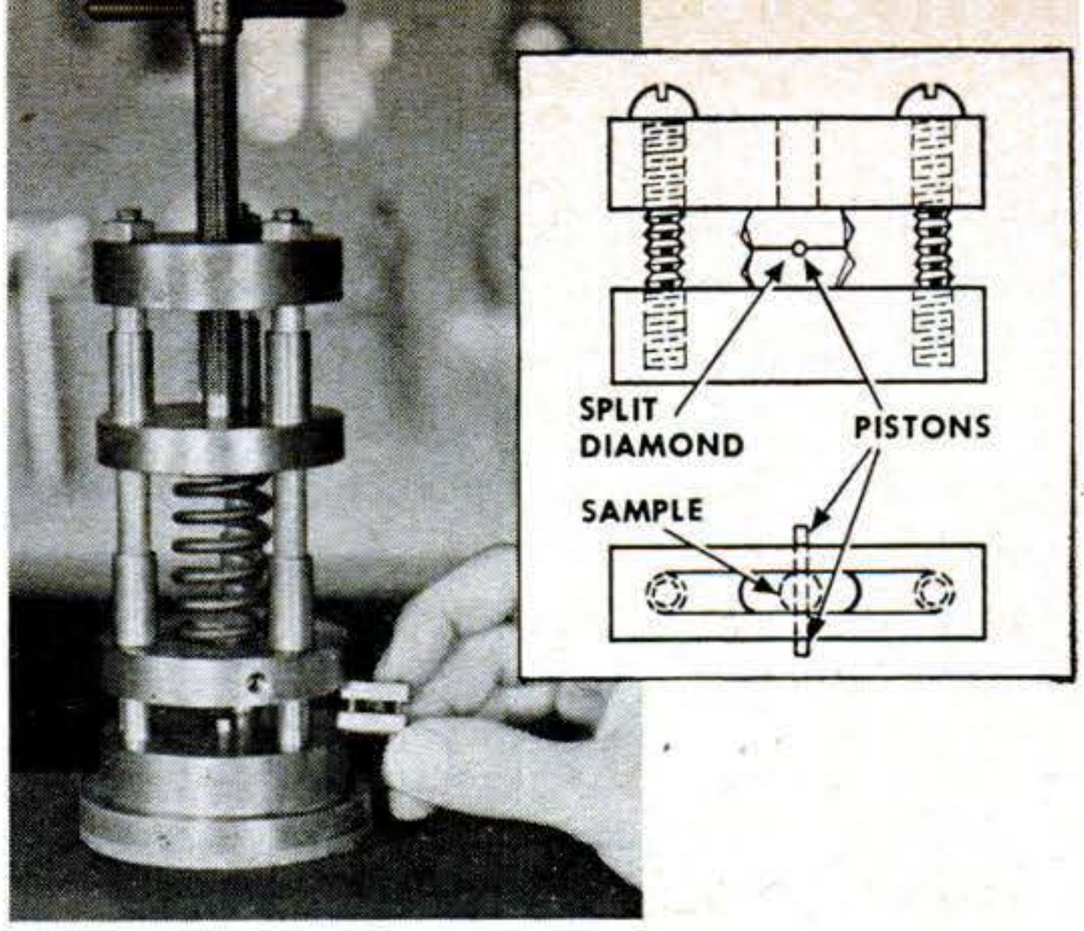


Giant Circuit Breakers Grow Horns

THESE odd-shaped Westinghouse switches, using 50 percent less cooling oil than former models, will be used at Bonneville Dam.



Diamond "Bomb" Takes High Pressures

THE tiny object held in the fingers above is a diamond "bomb" that makes it possible to study the effects on metals of pressures as high as 450,000 pounds per square inch.

Two drill-rod pistons fit in a .015-inch hole drilled through a $50 industrial diamond. The diamond is split along the plane of the hole to aid cleaning, but is clamped tightly together during experiments. A metal sample is inserted in the hole and pressure is applied to the little pistons by a spring-loaded hand screw. The phenomenal pressures are a result of the tiny bearing area. X-ray diffraction shows the atomic changes resulting from high pressure. The method was developed by Prof. A. W. Lawson, of the University of Chicago.

Super Broom and Trick Drum Lifter Save Government Time

THE triple-header broom below does a faster job of cleaning large floor areas than the broom next to it. Refuse is swept together into a neat pile when you close the pincers-like handles. It was developed by H. P. Ellis, a Federal warehouse employee who shows off another bright idea below—a drum-lift fitting that grips automatically.

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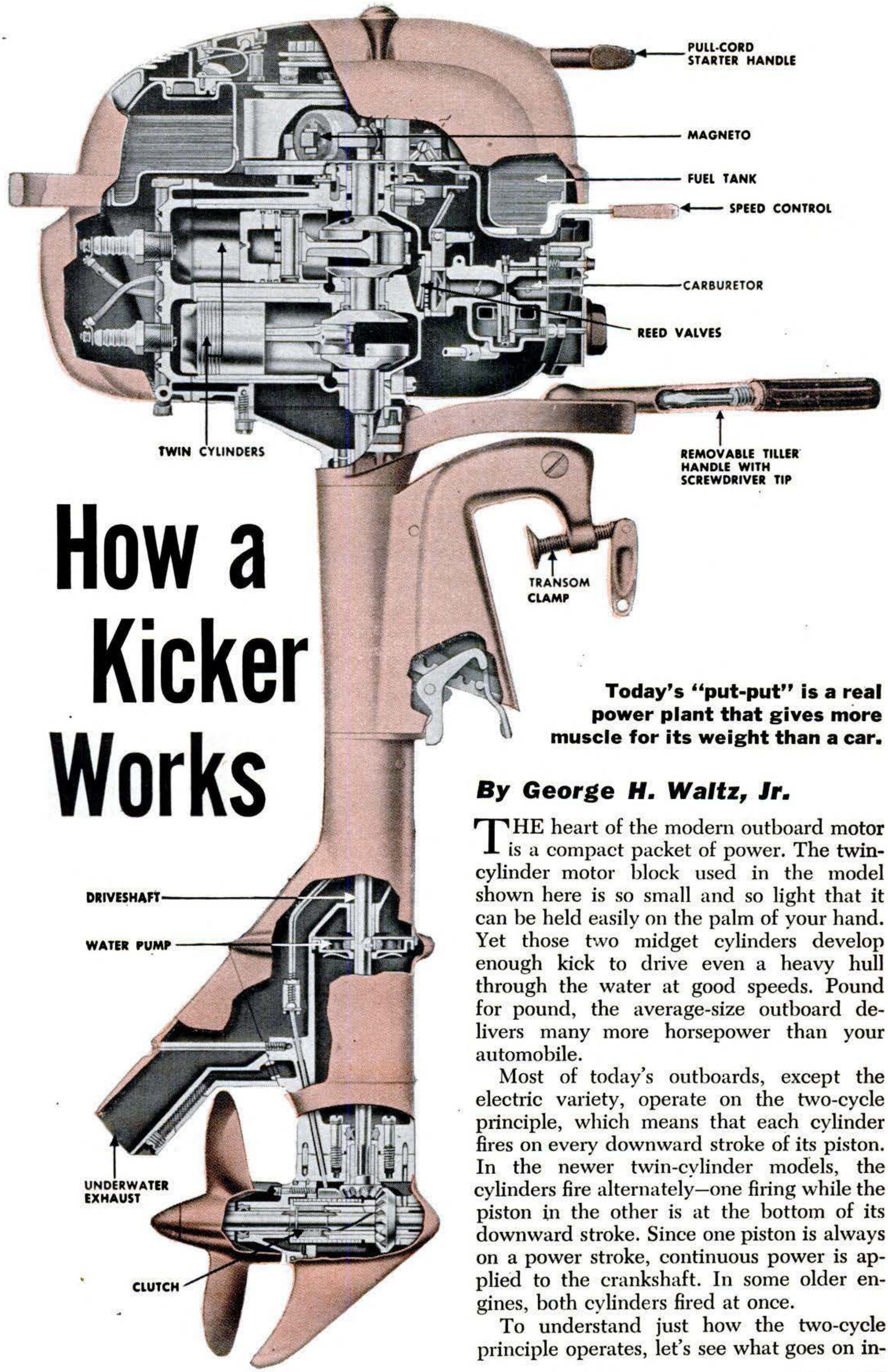

How a Kicker Works

Today's "put-put" is a real power plant that gives more muscle for its weight than a car.

By George H. Waltz, Jr.

THE heart of the modern outboard motor is a compact packet of power. The twin-cylinder motor block used in the model shown here is so small and so light that it can be held easily on the palm of your hand. Yet those two midget cylinders develop enough kick to drive even a heavy hull through the water at good speeds. Pound for pound, the average-size outboard delivers many more horsepower than your automobile.

Most of today's outboards, except the electric variety, operate on the two-cycle principle, which means that each cylinder fires on every downward stroke of its piston. In the newer twin-cylinder models, the cylinders fire alternately—one firing while the piston in the other is at the bottom of its downward stroke. Since one piston is always on a power stroke, continuous power is applied to the crankshaft. In some older engines, both cylinders fired at once.

To understand just how the two-cycle principle operates, let's see what goes on in-

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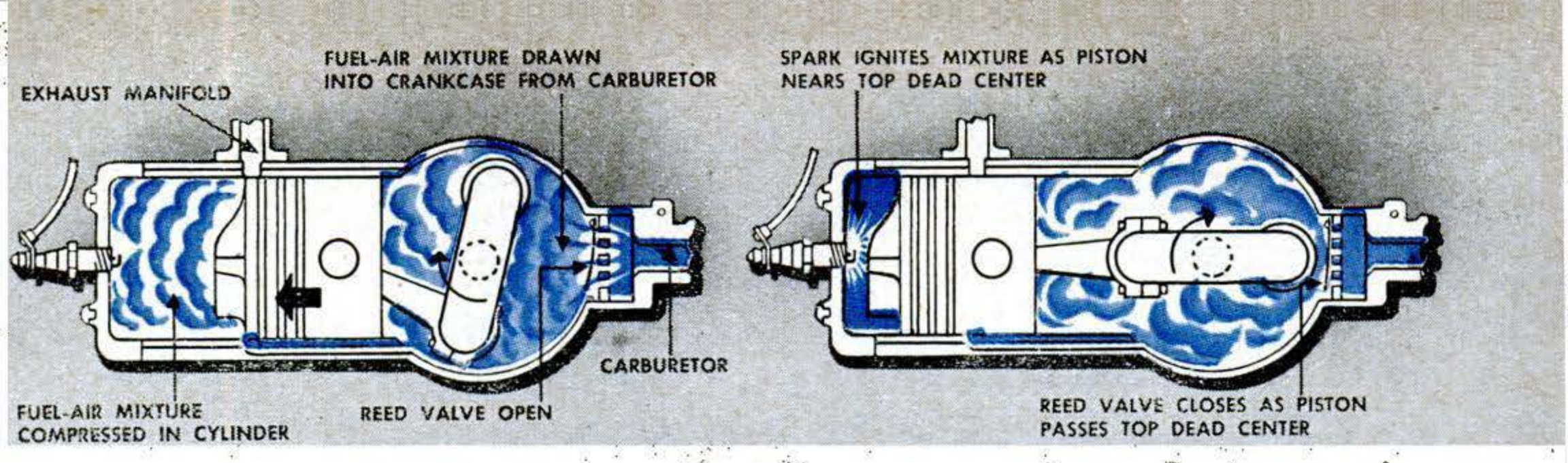


COMPRESSION **FIRING**

side a single cylinder of a typical outboard (see the drawings above).

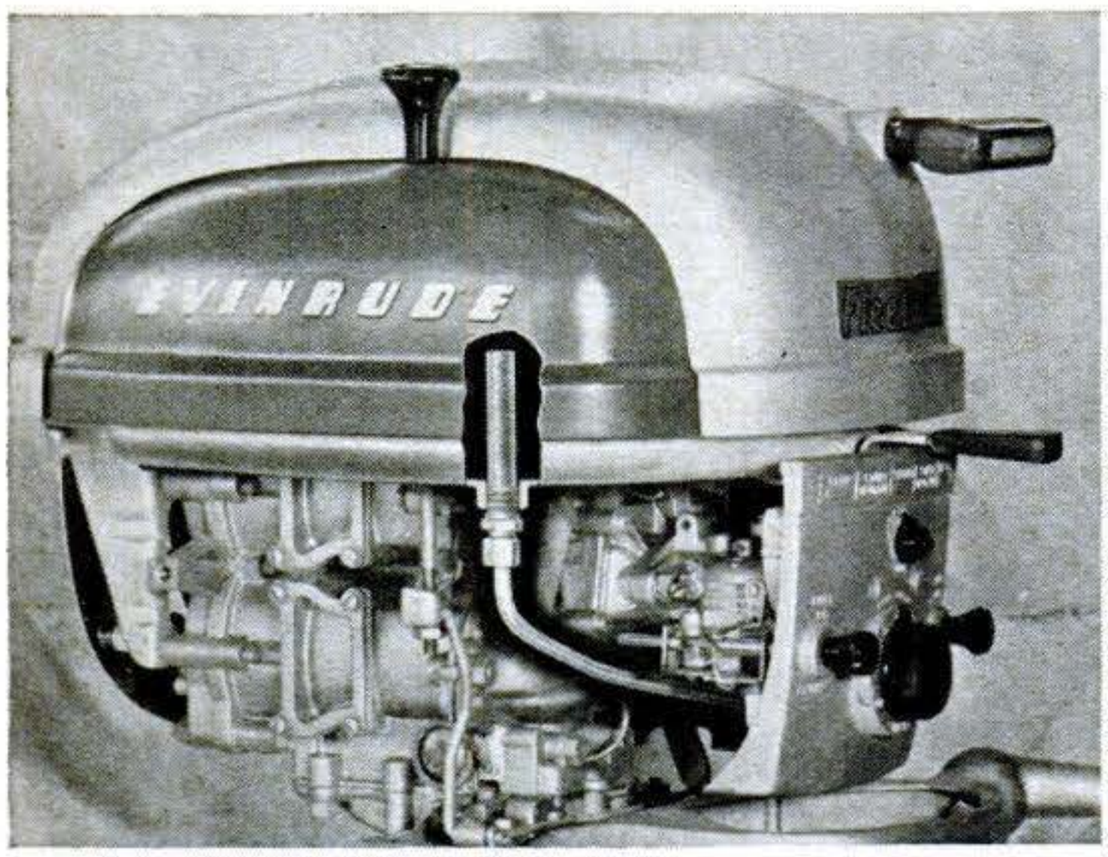
In this case, each cylinder has its own sealed crankcase, which is connected through a simple reed or flap valve to the throat of the carburetor. As the piston moves toward the cylinder head, it creates suction that opens the reed valve and draws the mixture of air and fuel (to which oil has been added for lubrication) into the crankcase. Then on the power stroke, the reed valve is forced closed and the piston compresses the mixture in the crankcase until, at the bottom of its stroke, it uncovers intake and exhaust ports on opposite sides of the cylinder wall. The mixture, under pressure, then rushes from the crankcase into the cylinder through the intake port, and the burned gases are forced out of the exhaust port. Both intake and exhaust take place almost simultaneously. On the upward stroke of the piston, the air-fuel charge is compressed and fired and the cycle repeats itself.

In the engine shown here, the cylinders are placed one above the other and one carburetor serves both through separate reed or flap valves in each crankcase. For ignition, current generated by a single magneto mounted on the top of the outboard's vertical driveshaft is fed to each spark plug through separate sets of breaker points.

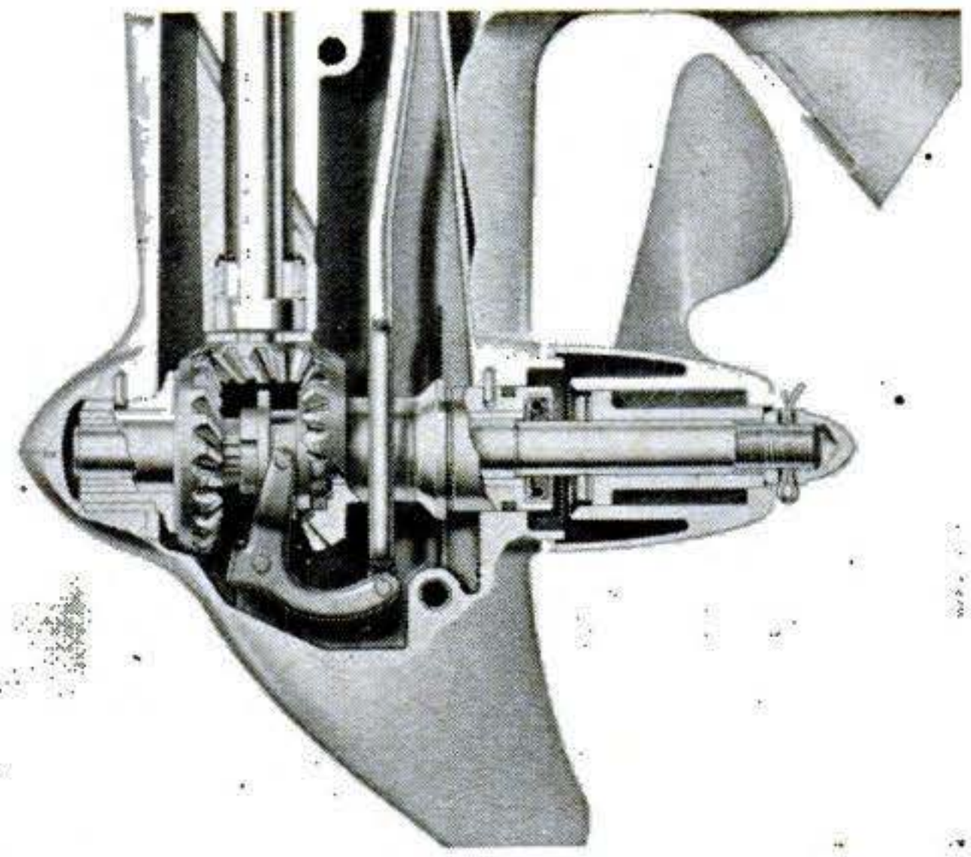
Most engines are cooled by water, although a few are air-cooled. Here water is circulated through water jackets by a pump designed to vary its output so that adequate cooling is obtained even at the slower speeds. This pump, designed to work as either a centrifugal or positive-displacement pump depending on motor speed, is mounted right on the vertical driveshaft.

Throttle Also Adjusts Spark

Speed is controlled on most outboards by a regulator lever on the power head or a twist grip on the end of the tiller handle. Movement of the regulator simultaneously opens or closes the throttle and advances or retards the spark. The two controls are interconnected through a cam and lever arrangement to provide just the right spark timing for any given throttle setting. Like the auto-



Cutaway model shows location of the twin-cylinder block, at left, and single carburetor that serves both cylinders, at right. Fuel tank, on top, surrounds the flywheel.



Gearshift drive is operated by shift lever connected to a pivoted arm that moves collar to lock either one gear or the other to the shaft and shift from forward to reverse.

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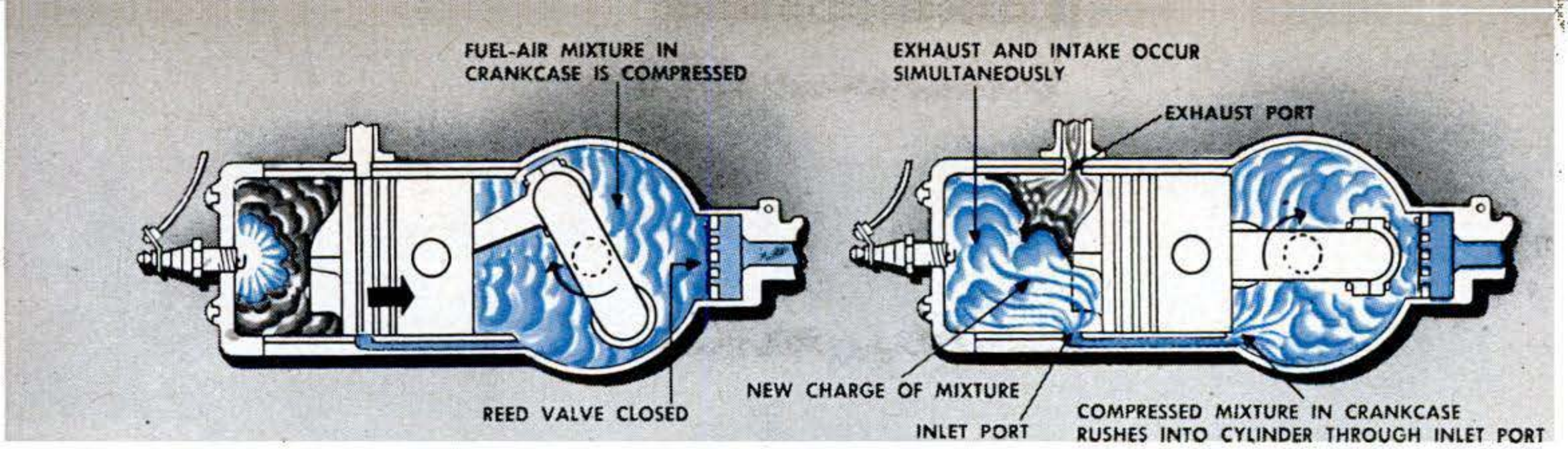
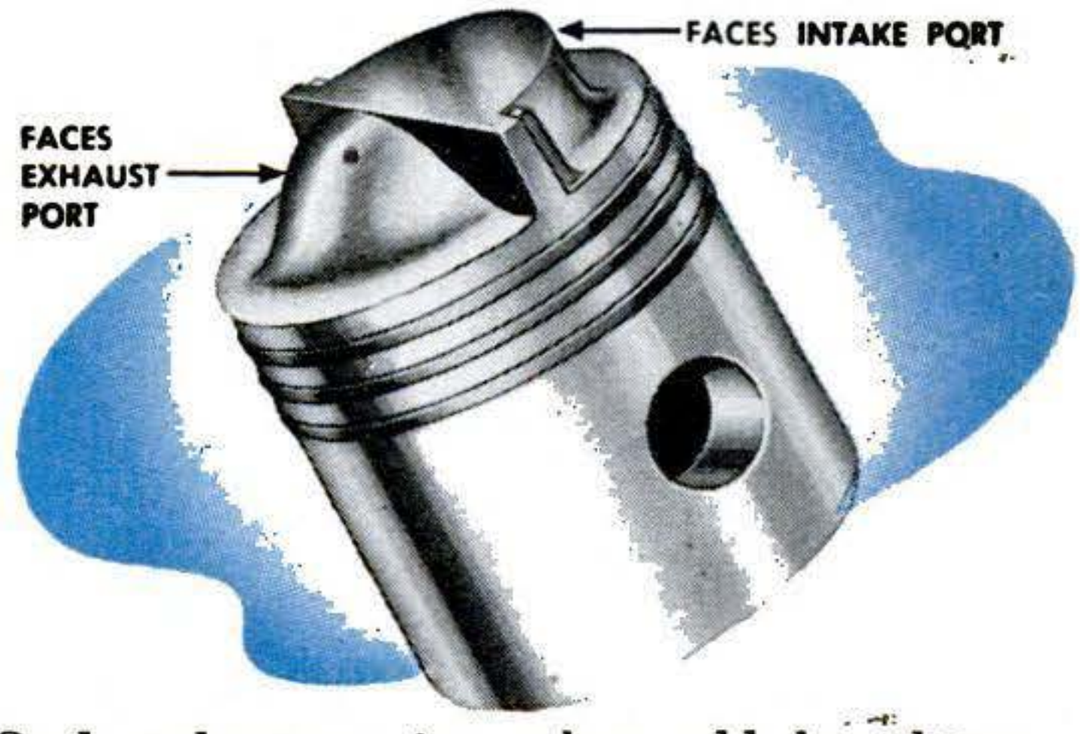


POWER-COMPRESSION **INTAKE-EXHAUST**

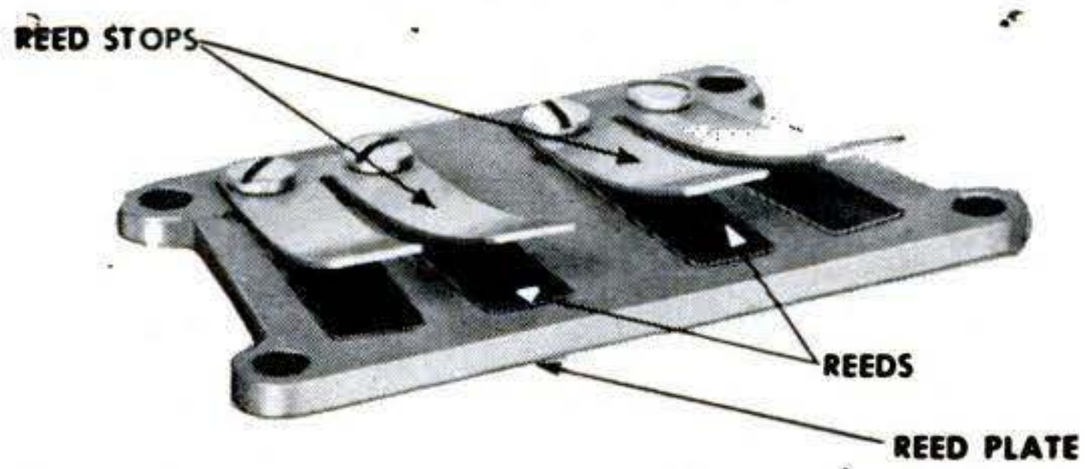
matic spark control used on the modern automobiles, it not only simplifies motor operation, but insures top efficiency and performance at all speeds.

The modern outboard motor has come a long way since the early days of the "kicker," thanks to modern materials and manufacturing techniques. Cylinders are typically die-cast aluminum alloy with tough iron sleeves integrally cast in to take the wear. Crankshafts are drop-forged nickel-molybdenum steel. Bearings are of sintered bronze or phosphor bronze. The engines themselves, like those in cars, are shock-mounted on rubber. And carburetors are of the float-feed automotive type.

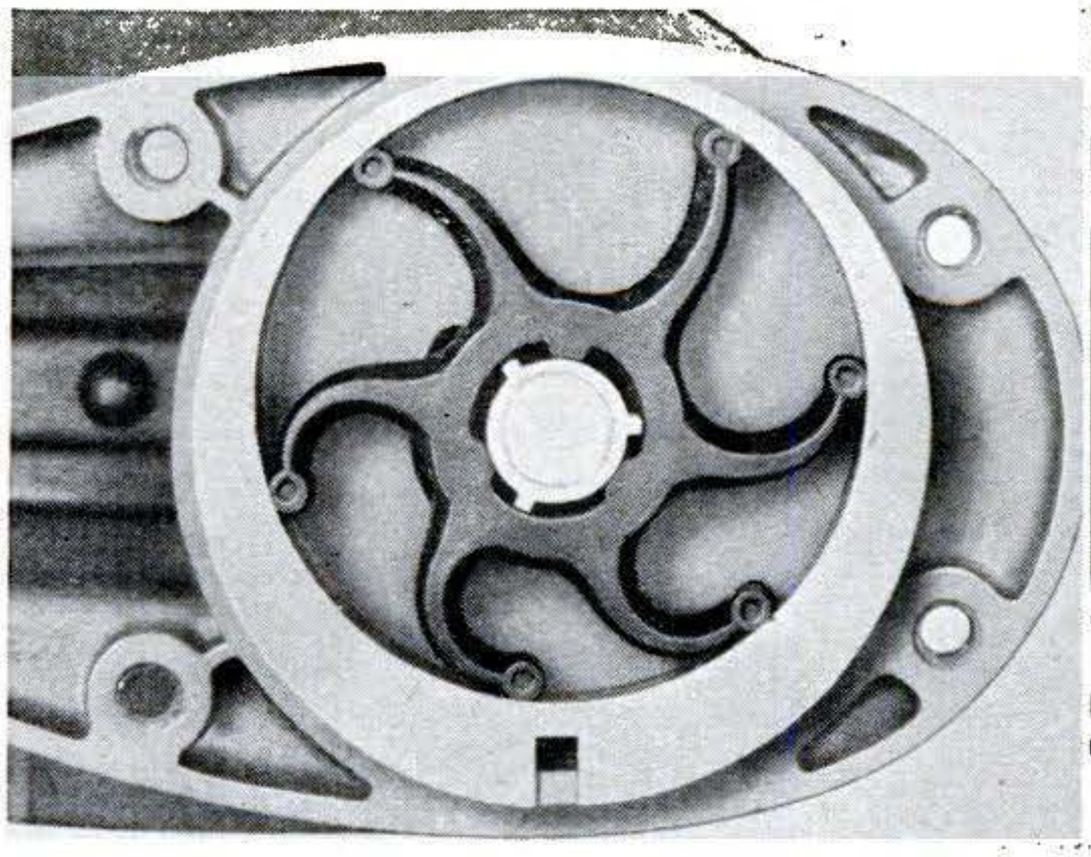
Among the mechanical innovations borrowed from the modern automobile are such refinements as gearshift levers that allow you to shift easily from forward to reverse; clutches—fluid as well as mechanical—that provide a true neutral for starting and idling and also protect the propeller from damage if it should hit a rock or submerged log; and automobile-type ignition breaker points that can be easily adjusted. END



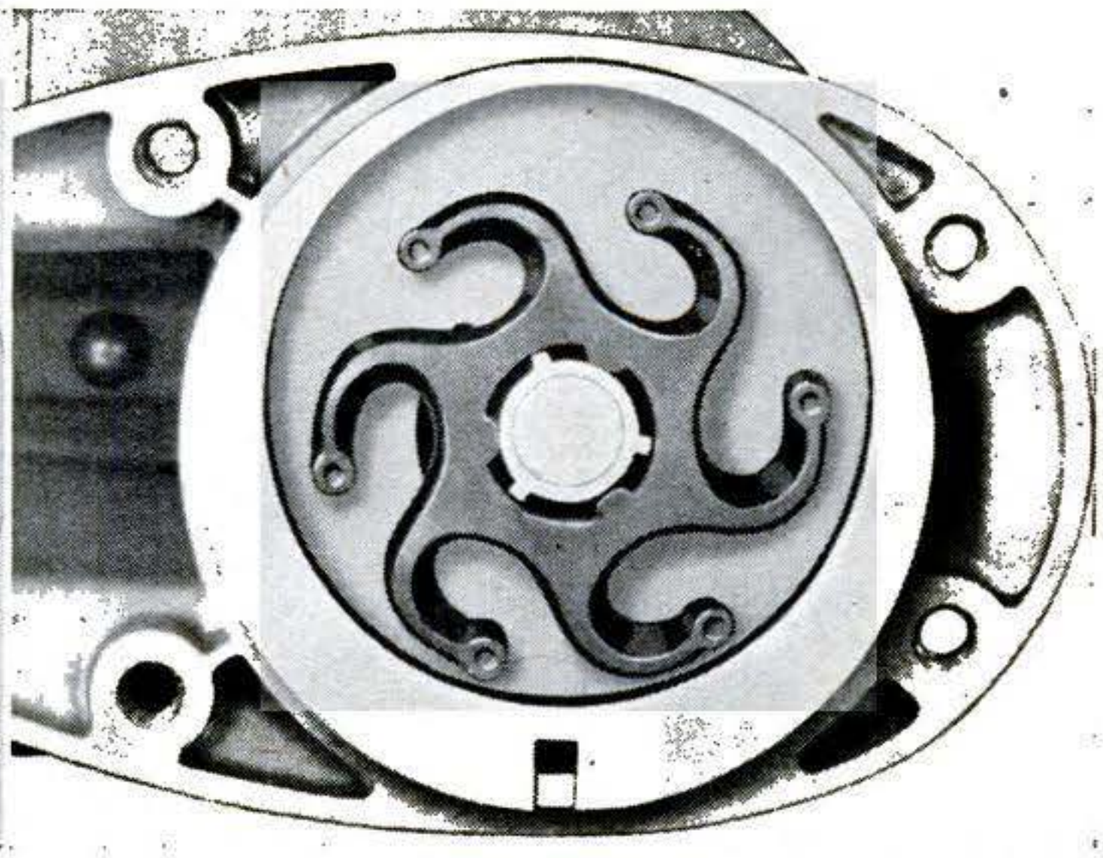
Outboard-motor pistons have odd-shaped tops to help channel the air-fuel mixture in and the burned exhaust gases out. If installed the wrong way around, engine won't run.



Reed plate and reeds, which act like flap valves, allow air-fuel mixture from the carburetor to enter each cylinder's crankcase when its piston is on upward stroke.



Cooling water, in most models, is circulated by a pump having a rubber impeller. At slow speeds, impeller blades are extended and the pump acts as a positive-displacement pump.



At high speeds, water pressure bends blades back and pump becomes a centrifugal pump. This insures correct water flow at all speeds. *(Photos courtesy Evinrude and Johnson.)*

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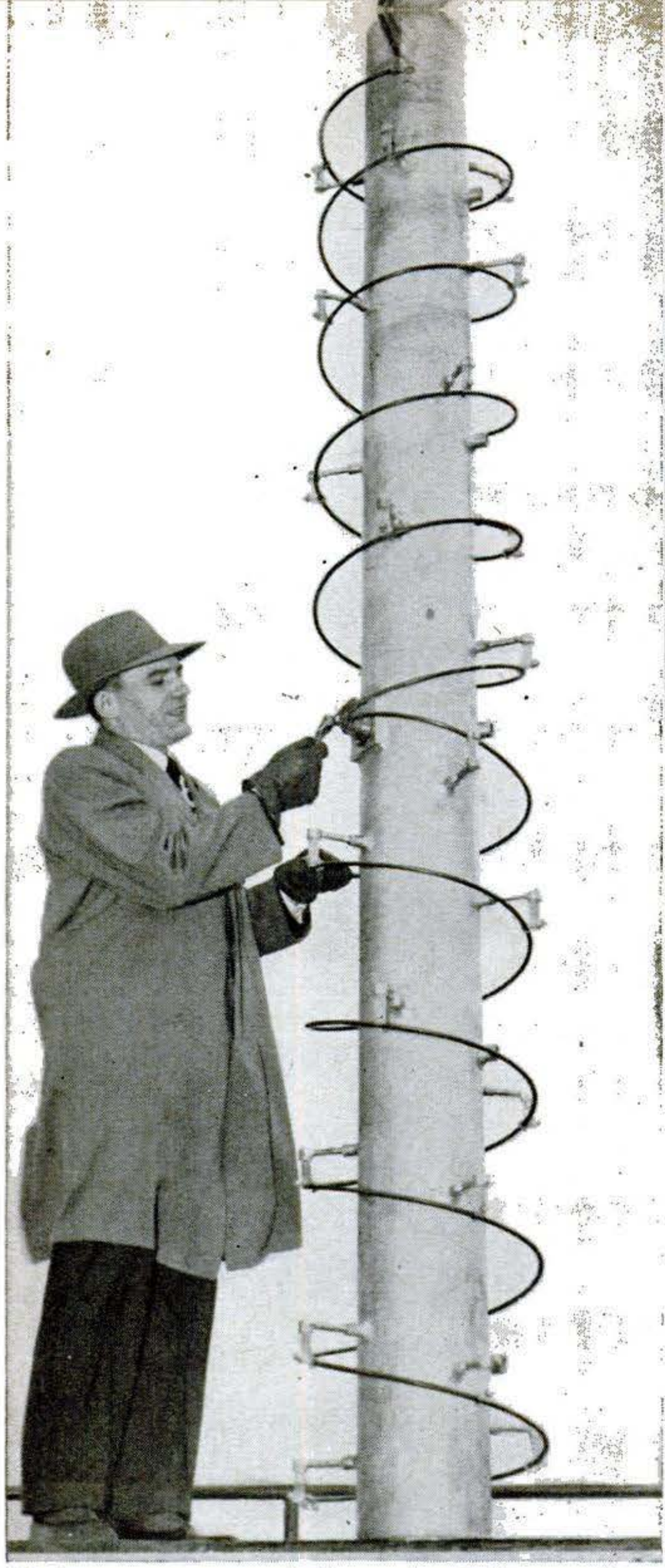

Corkscrew antenna helps make GE's new ultra-high-frequency transmitter the world's most powerful. Four sections like one above boost output of special five-kilowatt tube 20 times.

New converter for bringing UHF telecasts into present sets looks like small radio (above). Made for Crosley receivers, it needs only to be connected to antenna terminals (right).

Small Towns to Get TV on Small Waves

YOU may be watching television in small towns now off the TV map by next year. Tiny waves way up in the ultra-high frequencies near radar make this possible. These frequencies have now been tentatively assigned by the Federal Communications Commission to 1,357 stations. And TV manufacturers are already working on transmitters to broadcast them and receiver attachments to pick them up.

Today's television operates in the very-high-frequency range, which has room for only 484 stations (107 are already on the air). More stations than that would interfere with each other. Thus, only the roomier UHF band can provide new stations for areas that now get poor video or none at all (PS, Aug. '50, p. 111).

Present TV sets are VHF and cannot receive UHF at all. But most manufacturers are developing converters that will let them get both types of telecasts.

Crosley has a converter for its receivers that looks like a table-model radio. It is simply connected to the antenna terminals of the regular set. RCA, GE, and Zenith have also tested such attachments.

Transmitters are a problem, too, since comparatively high power is needed to cover sizable areas with these very short waves. General Electric has developed the most powerful station yet. It can produce 100 kilowatts. Westinghouse is trying out a wartime radar-jamming tube for UHF.

While UHF television has been tested experimentally for some time—in Bridgeport, Conn., for example—commercial operation is not expected before next year. Some delay is likely before the FCC gives its final approval. And manufacturers are so busy that transmitters may be held up.

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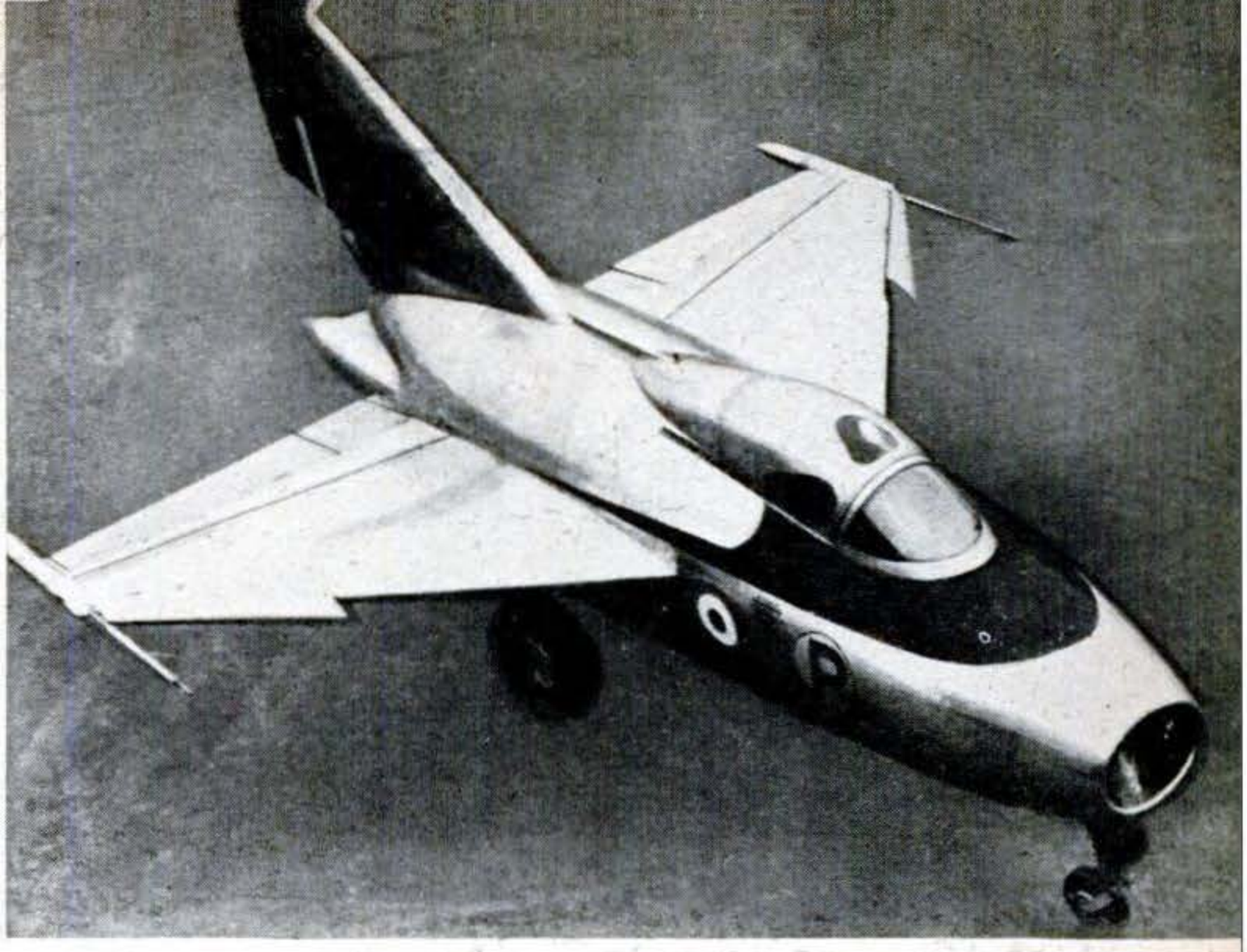
British Fly Delta Wing

A BRITISH plane with a delta wing, similar to triangle-wing planes undergoing tests in the United States, has made its first flights. The Fairey Delta, powered by a Derwent turbojet, is intended to match or exceed sonic speed.

The sharply sweptback wing has a span of only 19½ feet. Control surfaces on the trailing edge serve as both ailerons and elevators. The wingtips house parachutes to stop possible spins during trials.



Tractor Powers Milking Machine

JAMES PERKINS, of Warren, Conn., isn't caught without power for his milking machine if electricity fails. His tractor's power take-off drives a generator, eliminating the cost of an infrequently used standby engine.

Treadmill Paces Track Men

WHEN the weather goes sour, Cincinnati's Central Vocational High School trains its track men on a treadmill. Speed of the home-built, motor-driven belt can be varied by the coach so he can pace the runners.

Robot Counter Sorts Auto Speeds

TRAFFIC engineers in Los Angeles are counting cars by a new machine that sorts them out according to speed. When a car crosses two detecting strips, the time it takes is translated into miles per hour, and the car is recorded on one of 10 counters set to total the number of cars in each speed range. A dial records the exact speed of any selected car. U.C.L.A. developed it.

Main line of proposed monorail system straddles concrete-lined bed of Los Angeles River. Passenger platforms would be elevated. Rails, not shown in detail here, would be suspended from crossbeams to give power trucks clearance.

Monorail Trains Planned to Speed Los Angeles Traffic

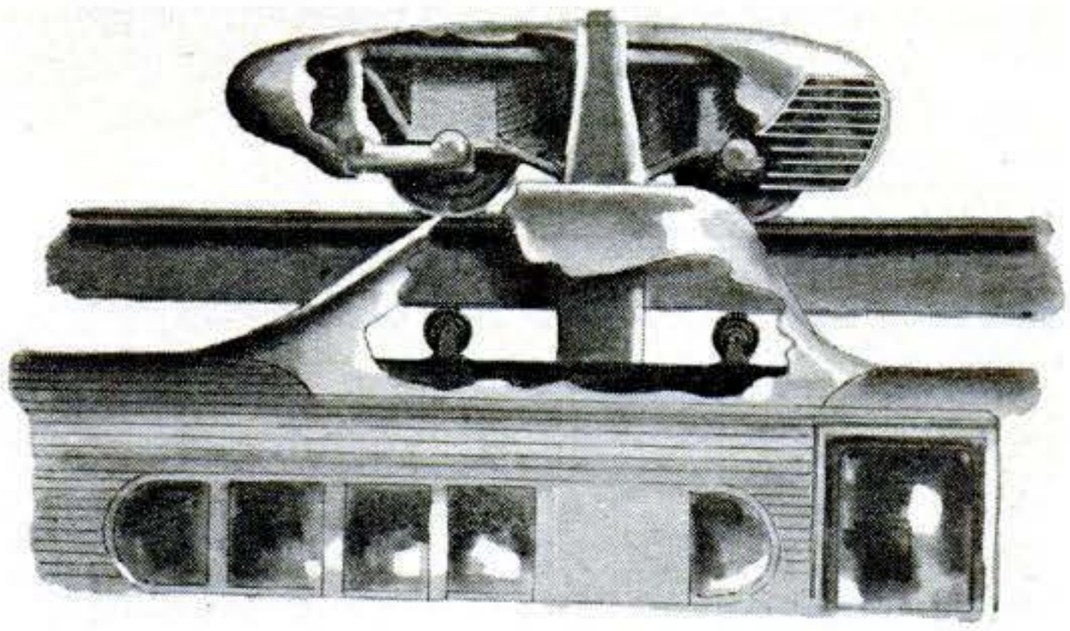
THESE drawings—no dream for a super-thrill carnival ride—are based on engineers' plans for America's first monorail rapid-transit system.

Swinging from a single overhead rail, 10-car trains carrying 1,000 passengers would whisk commuters into downtown Los Angeles from inland and harbor areas up to 25 miles away. State and local authorities are now studying the proposal as a means of relieving congested surface traffic.

Aluminum cars, shaped like air-liner fuselages, are designed to swing out—safely—as much as 15° on curves and hit close to 70 m.p.h. on straightaways. Each car would hang from four double-flanged wheels in a pair of power trucks. Each wheel would be driven by its own 55-hp. motor.

Backers of the system, estimated to cost $1,000,000 a mile, point to the safe operation of the world's only monorail transit system in Germany. There a line along the industrial Wuppertal valley has carried 310 million passengers in the last half century.

Designs for the Los Angeles project were worked out by the J. M. Montgomery Engineering and Construction Co. They are based on studies made for the Southern California Monorail System by Allen E. Puckett, former wind-tunnel chief at Caltech's jet lab. A similar system is being considered for San Francisco's bay area.



Cutaway shows one of two self-powered trucks supporting each car. Convex rollers on top of car press upward against underside of rail to keep main wheels from jumping the track.

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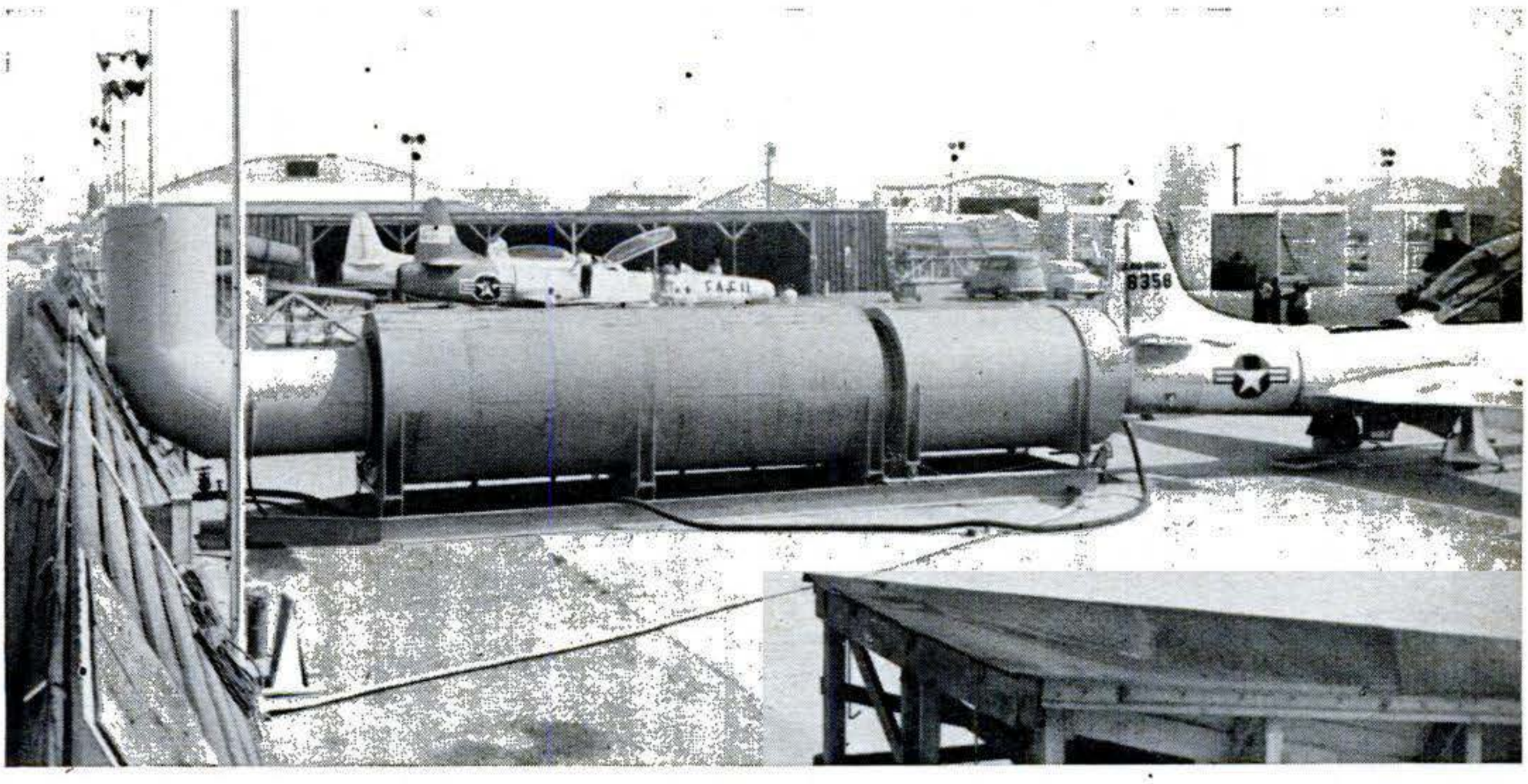
Upside-down elevated railway in Germany looks like this. Connecting Elberfeld and Barman, its trains travel at 30 m.p.h. for the 8½ miles. This line is a half-century old.

Giant Tube Muffles Roar of Jet Engines

FACED with complaints from nearby residents of California's San Fernando Valley that its jet engines made too much noise during ground runups, the Lockheed Aircraft Corp. slapped silencers on its F-89s. The king-size tube running from tailpipe of the plane below is lined with sound-deadening glass fiber. The curlicue at the end is a Maxim-type silencer for extra measure. Noise is reduced by a third.



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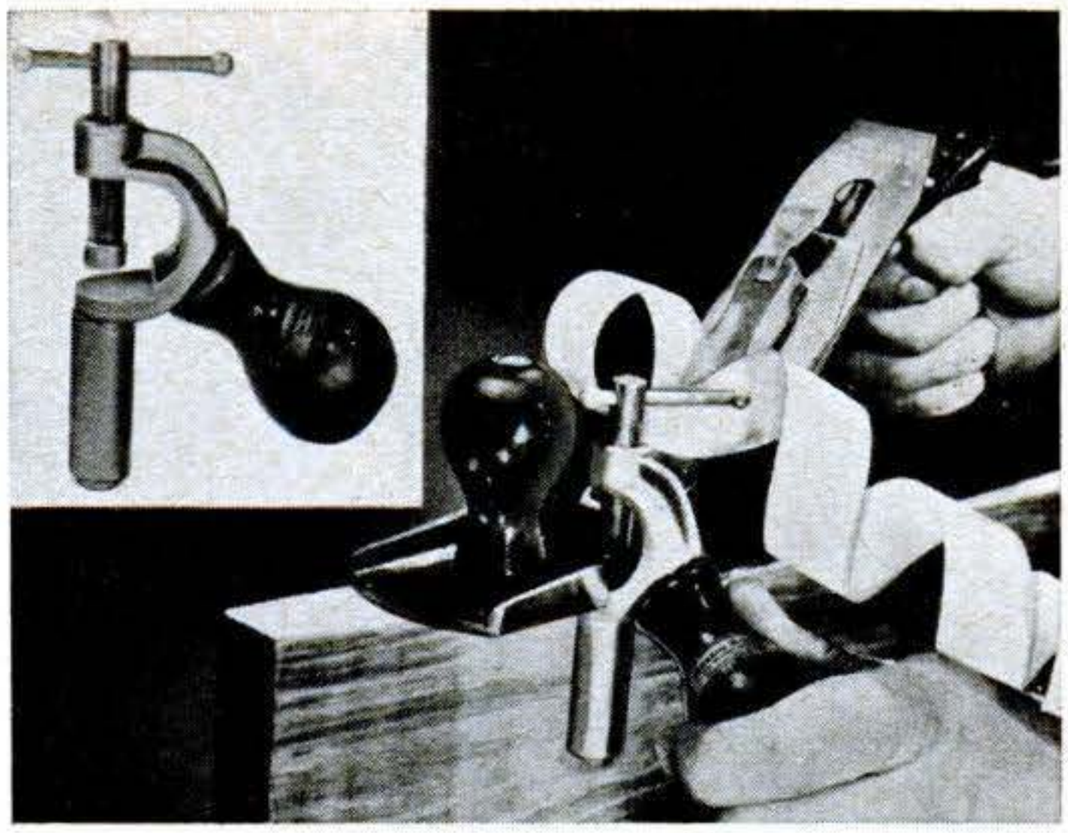
Rubber Block Holds Sandpaper Strips

THREE spikes underneath flaps at each end of this all-rubber sanding block grip the ends of 2¾ by 9-in. strips of sandpaper. The tool can be used for dry or wet sanding. The Minnesota Mining and Mfg. Co., of St. Paul, prices it at about $1.30.

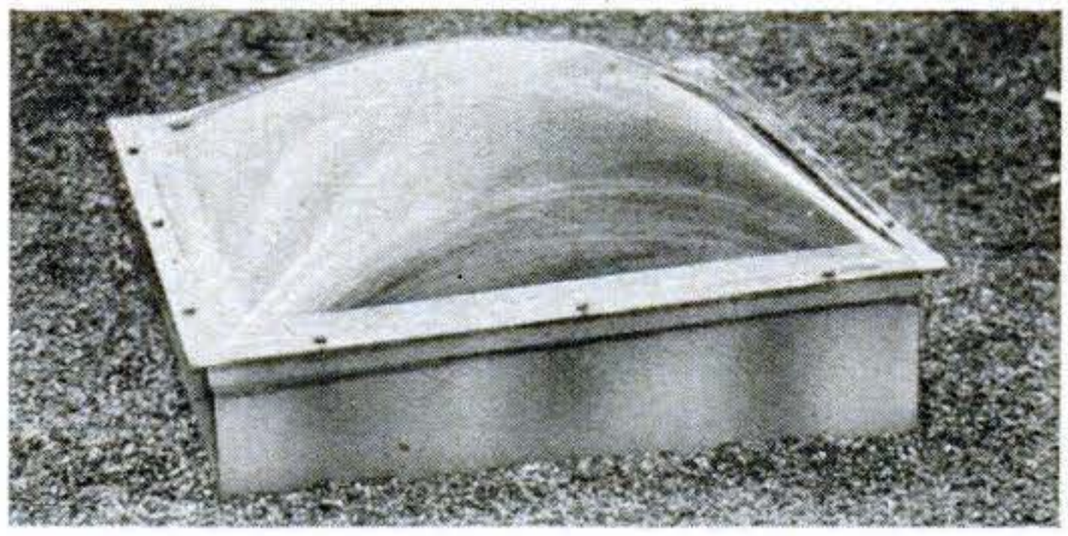


Attachment Keeps Plane Square

WITH this attachment you can plane a perfectly square edge every time. It can be clamped to either side of the plane. The cylinder rides against the side of the work, keeping the plane at 90°. Bratton Co., Edwardsville, Kan., prices it at about $4.

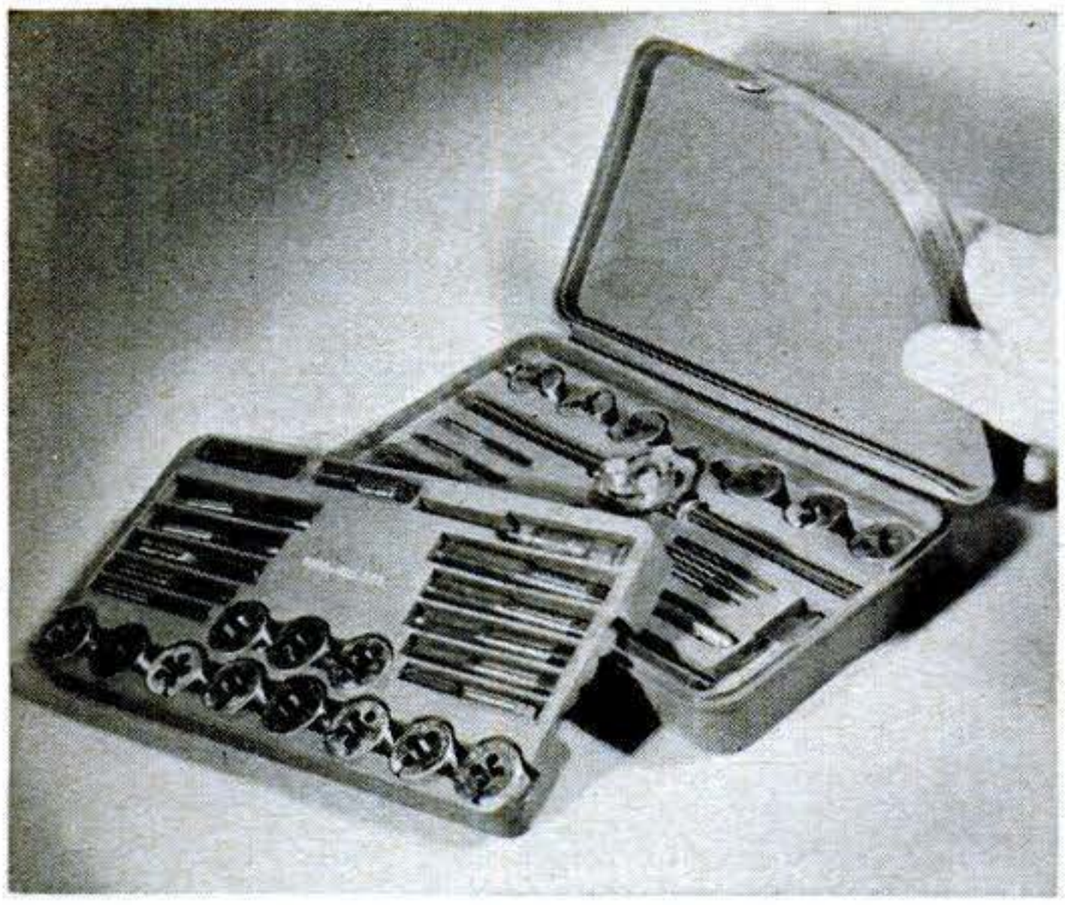
Plastic Domes Lighten Dark Rooms

DOMED skylights of clear or translucent Plexiglas, framed in metal, are now available for residential or industrial use. The unit can be installed in a matter of minutes in a regular skylight aperture. Standard sizes, ranging from 20 inches square to 64 by 96 inches, are manufactured by the Wasco Flashing Co., Cambridge, Mass.



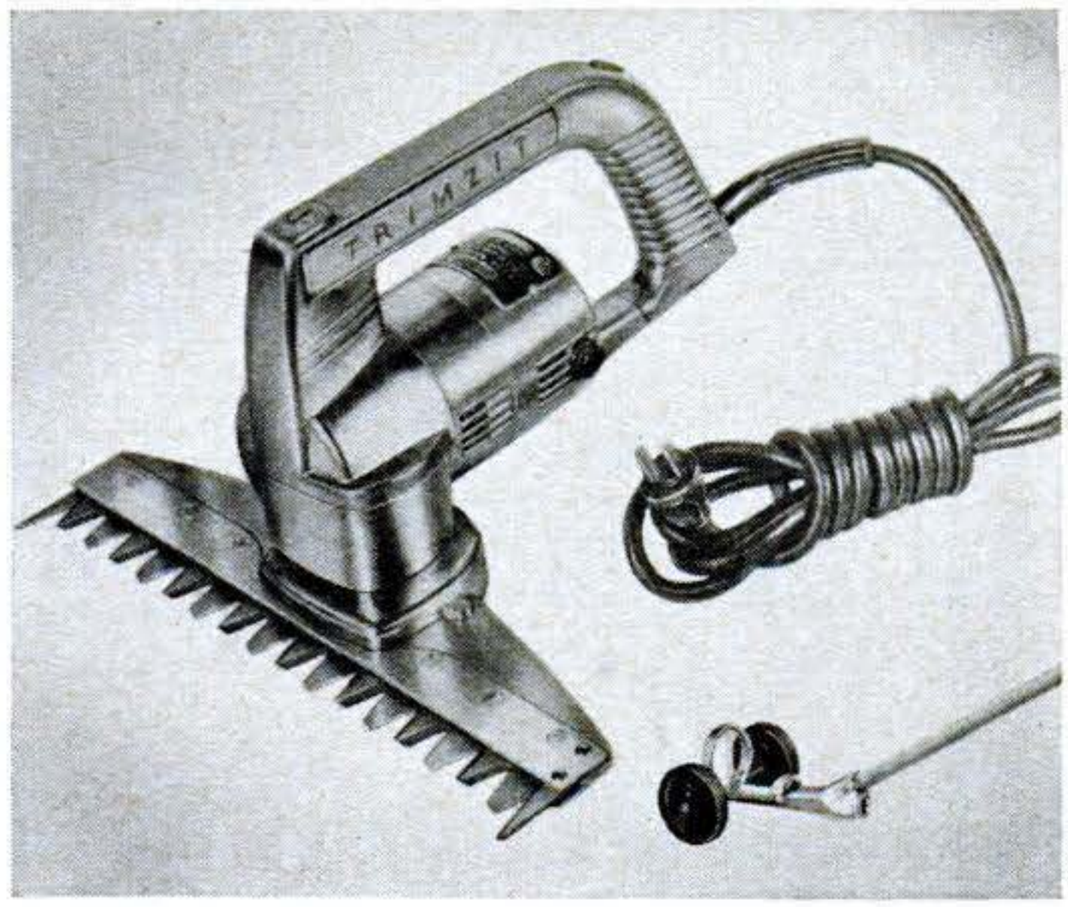
Flexible Case Houses Taps and Dies

BOTH smaller and lighter than wooden or metal cases, this flexible Bakelite case is resistant to abrasion, oil, grease, moisture and most chemicals. The hinge is molded as a part of the polyethylene case. A table of tap-drill sizes is molded in the lid for ready reference. Rinck-McIlwaine, of New York City, is the distributor.



Electric Shaver for Shrubbery

YOU can hold this unit in your hands to trim low hedges, mount it on a wheeled handle to trim edges of lawns, or use the handle to reach overhead branches of trees and shrubs. A 1/20-hp. universal motor powers the trimmer. A wall storage rack is furnished with the unit. The Electric Spray-it Co., of Sheboygan, Wis., is the maker.



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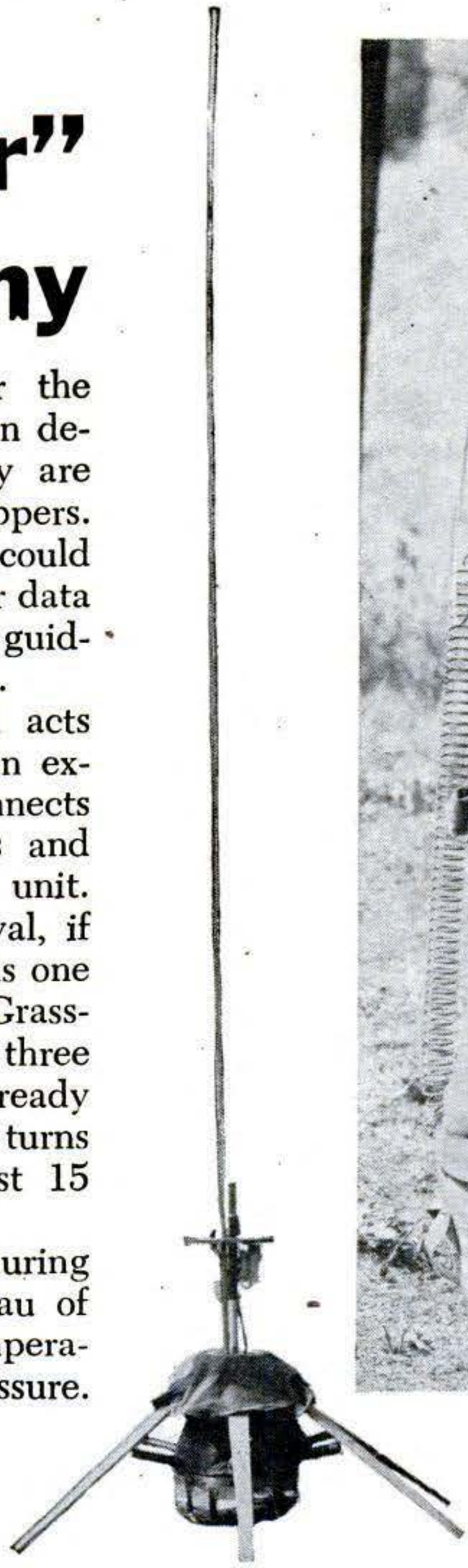
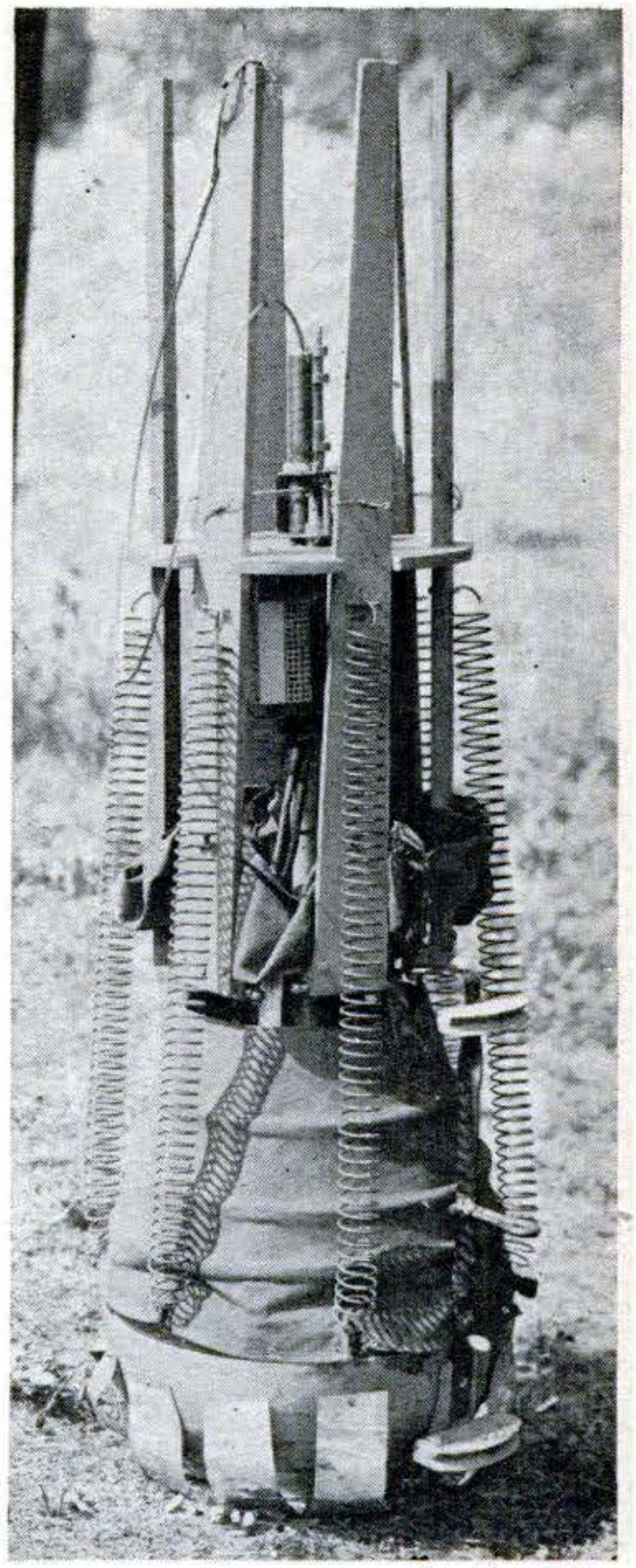
"Grasshopper" Spies on Enemy

ELECTRONIC spies that uncover the enemy's weather secrets have been developed by the United States. They are robot radio stations named Grasshoppers. Parachuted behind enemy lines, they could measure and transmit strategic weather data automatically. They might also send guiding signals to lead bombers to a target.

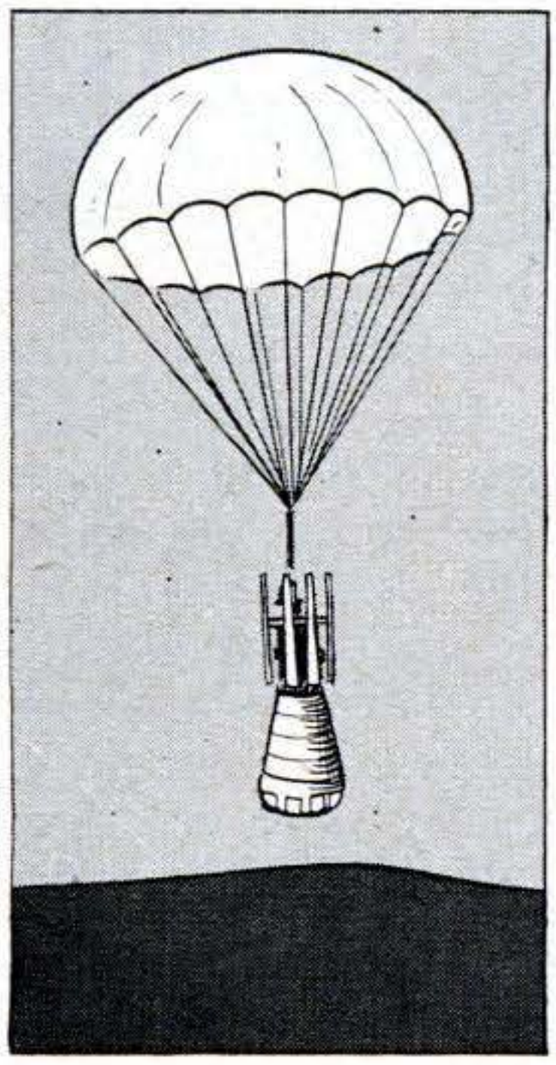
This weird robot really looks and acts the part. When it hits the ground, an explosive charge goes off. That disconnects the parachute, which is conspicuous and which might otherwise drag the unit. Later—after a preset "dormant" interval, if desired—there's another explosion. This one unlocks spring-loaded legs, and Grasshopper stands up. Explosion number three shoots up a whip antenna. Then it's ready to send whenever the built-in clock turns the transmitter on. The batteries last 15 days if it reports every three hours.

The standard model, developed during World War II by the National Bureau of Standards for the Navy, measures temperature, humidity, and barometric pressure. Its pulses tell which Grasshopper is reporting in, and signal when the batteries are fading. END

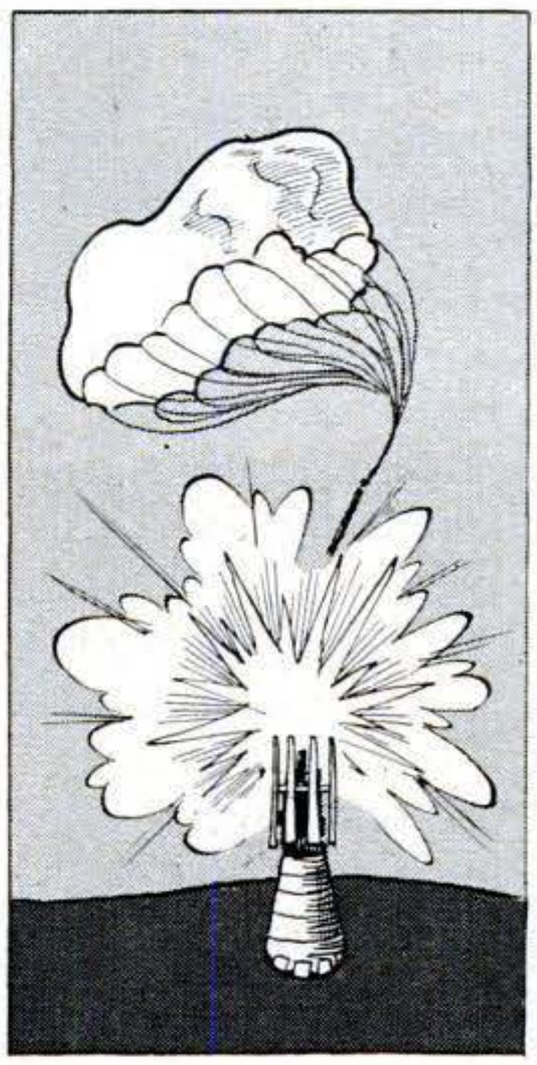




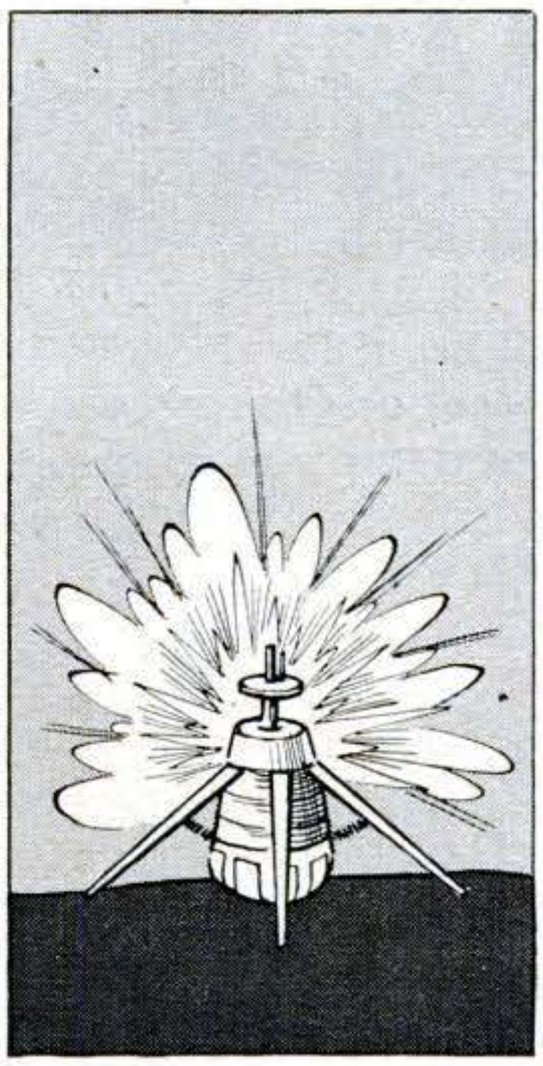
Robot spy looks like bomb (above) before it is dropped. It unfolds and transmits by itself (left).



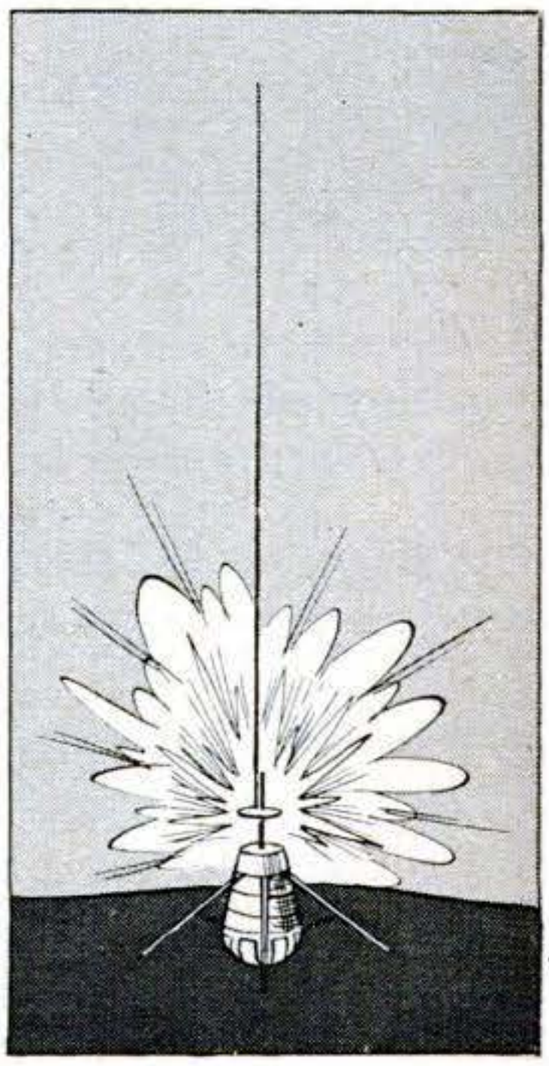
1 Parachute floats automatic spy unit to ground.



2 Explosion disconnects chute so unit won't be dragged.



3 Explosion-released legs can right spy if it lands on side.



4 The last explosion sends antenna up, and unit is ready.

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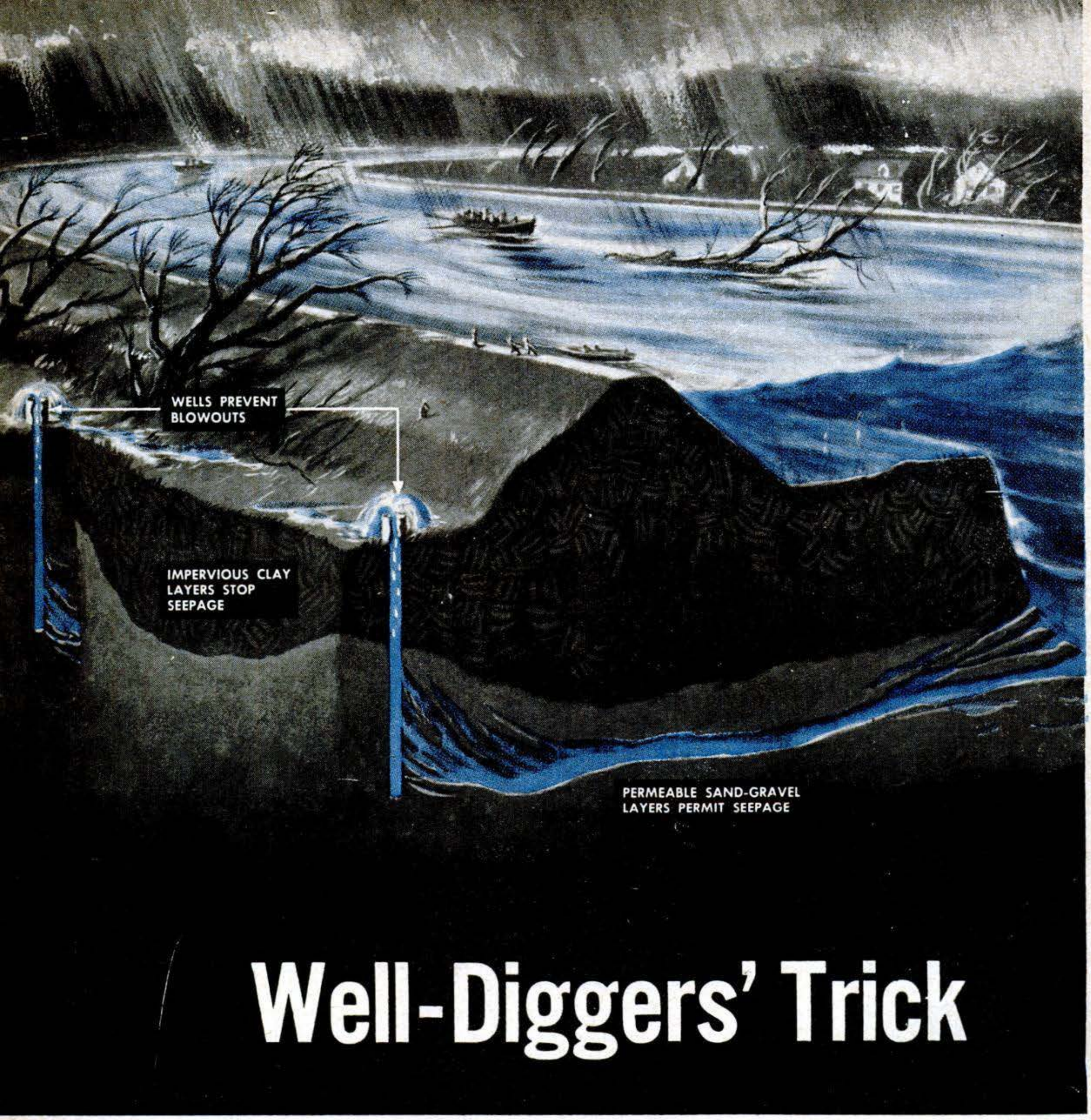

Well-Diggers' Trick

Using a new version of an old well-drilling method, flood-control engineers are protecting levees from deadly seepage.

By Austin H. Phelps

DRAWINGS BY WALTER POPP

ENDLESSLY, sullenly, the yellow water rushes downstream between the levee walls. Weeks of rains have sent the river to flood levels; only the curving dike of earth keeps it from pouring out over the flat countryside. But the crest is past, and the anxious watchers know that if the levee holds another day the danger will be over.

And then it happens. A few feet back from the levee a little spring of water bubbles up. Even as the alarm is sounded, it widens, shooting a stream of muddy water into the air. The levee guards rush to ring the spot with sandbags, but it grows, pouring out sand and mud—and water. In a few hours the levee wall beside it softens, settles, crumbles, water laps over the top, and the flood pours through the gap.

That bubbling spring of water and mud

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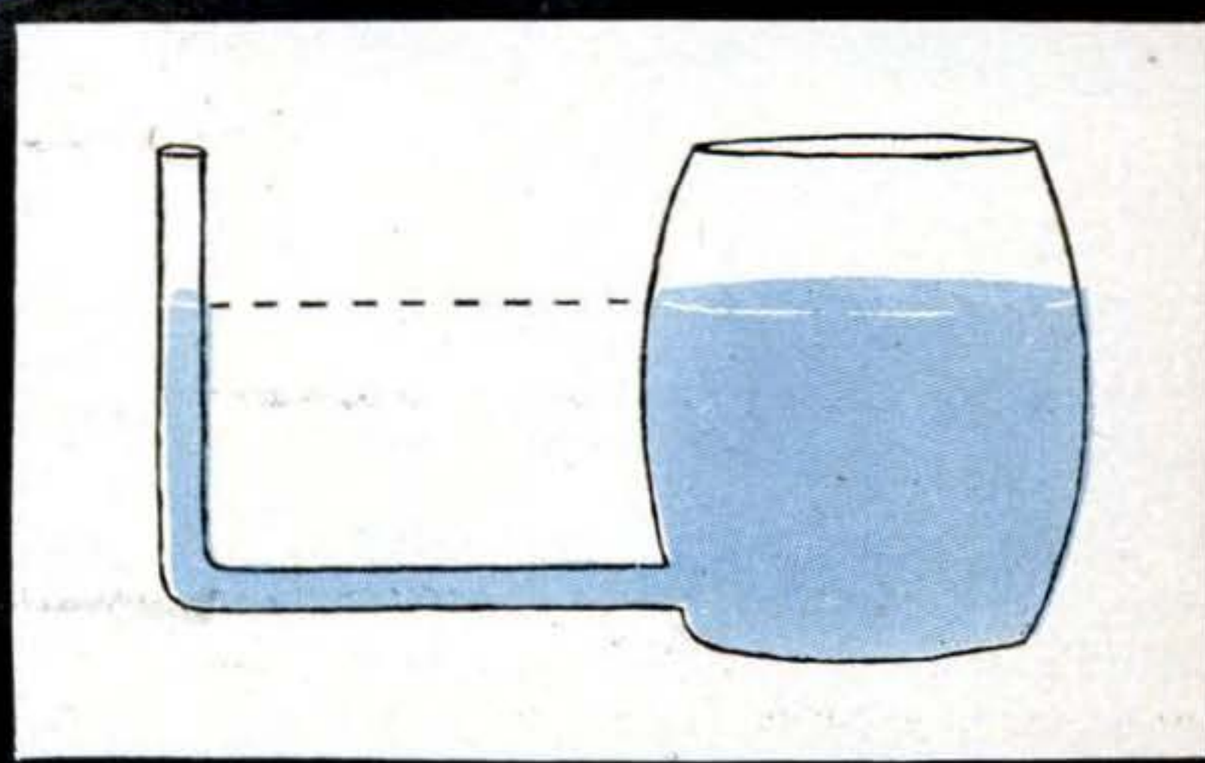
BLOWOUT UNDERMINES LEVEE, WHICH COLLAPSES AND RELEASES FLOOD



Principle of levee-saving seepage wells is shown in inset. Well forms second "arm" to complete U-tube arrangement that lets seeping water find its own level easily. Without well, water would still seek river level — but would force its own channel to surface, frequently tearing out levee foundation in the process.

Saves Levees

is what levee men call a sand boil, or blowout. They've struggled with thousands of them since the first levees rose along the riverbanks. All too often they've lost. But last flood season the picture was different along certain stretches of the Missouri. The swollen river was there, but the deadly blowouts weren't. Instead, small streams of water bubbled gently from pipes driven into the ground behind the levee. The dikes held.

Behind this victory—which may mean safety for thousands of square miles of bottom land—is the new science of soil mechanics. The cause of the sand boils lies in the layers of soil under the riverbank. Where those layers include sand or coarse gravel, they admit water, forced down by the swollen river above. The water works along the sand out behind the levee, and where the top layers of regular soil are thin, the water breaks out through the surface. The river feeds the boil with more water under pressure that all too often washes away the levee foundation.

The soil-mechanics experts studied the problem, and suggested an answer. Why not

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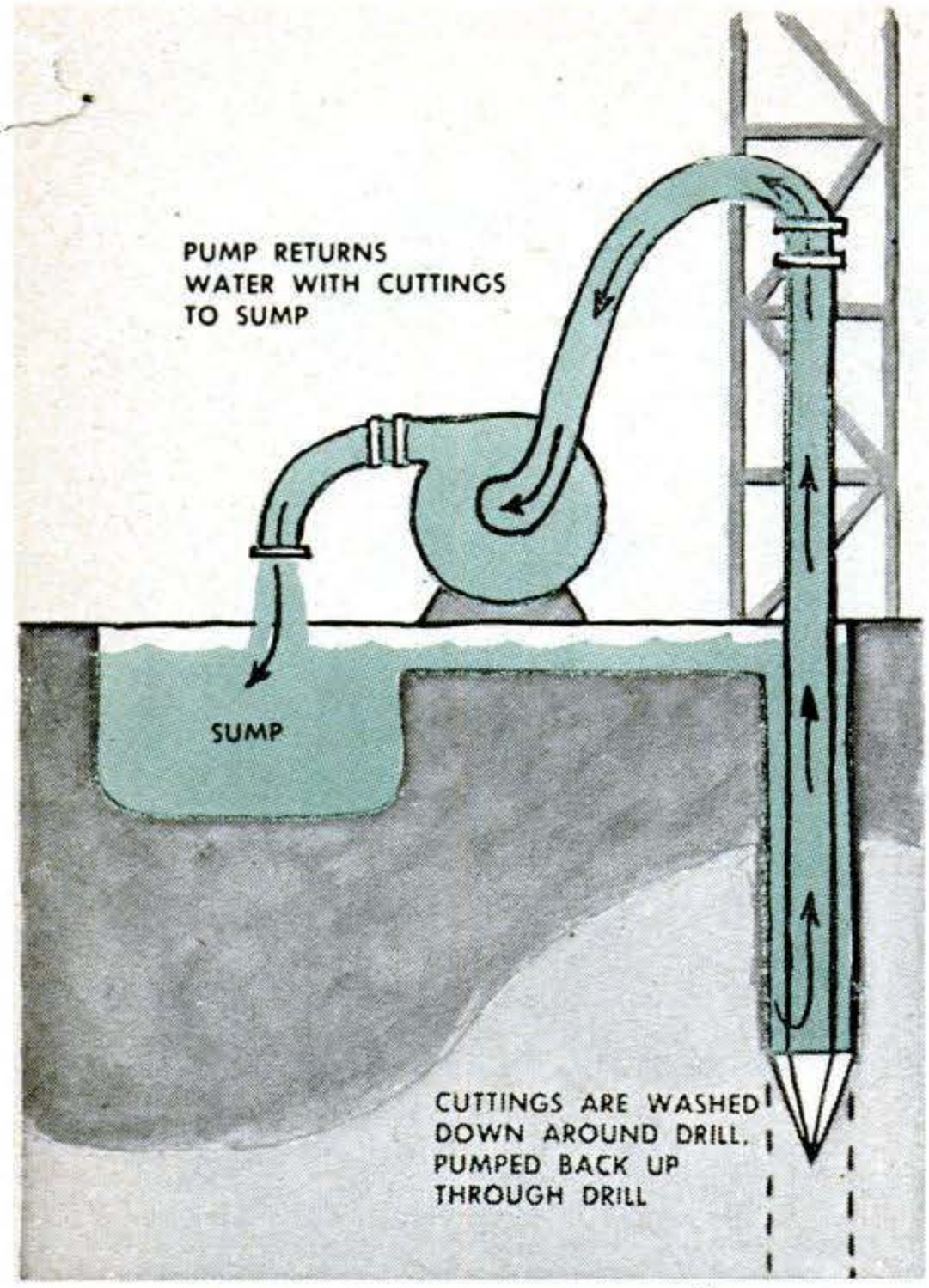
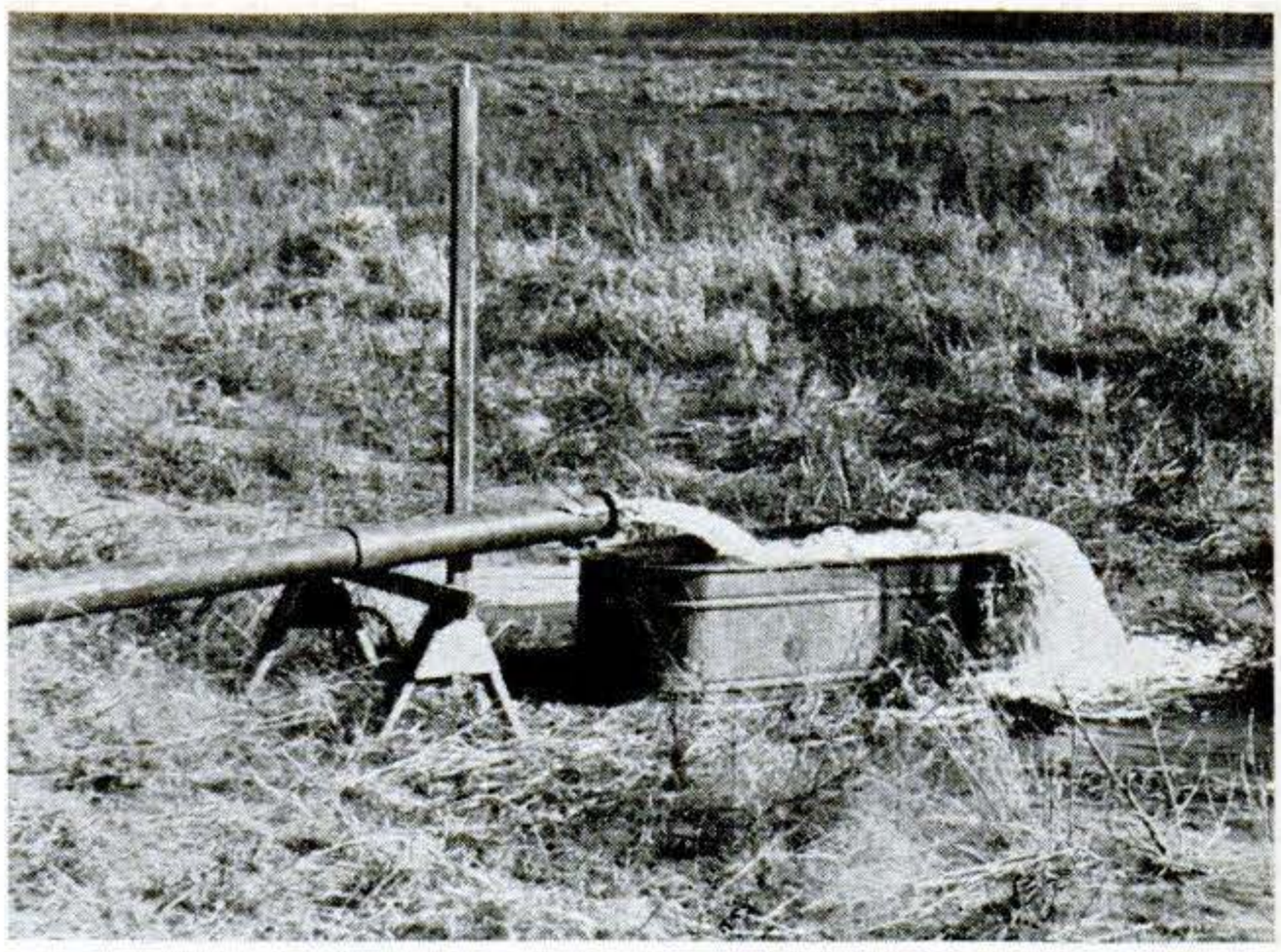


In reverse-flow drilling, water washes cuttings down around drill. Pump sucks them up through hollow drill, pours them into sump. Gentle washing does not harm wall, so casing is not needed.



Here water flows from a well during several hours' pumping after drilling is finished. This sets up a "cone of influence" around the bottom of the well to intercept the flood waters.

put a safety valve for the dangerous high-pressure water in those under-levee channels of sand and gravel? Provide an easy way for that water to escape. Then it wouldn't burst through by itself.

If they could drive small pipes into the underground streams *behind* the levee, reasoned the experts, the water would simply well up harmlessly in those pipes.

But first the engineers had to find out where to put the safety valves. All along behind the protecting dikes, the underground layers of dirt had to be investigated to learn where the layers of sand or gravel were so near the surface that the impervious layers of clay and silt above were likely to blow out. This was done by sampling the dirt. A tube six inches in diameter and two feet long was driven into the earth. When the tube was pulled up, it held a core of dirt.

At the laboratory, the dirt was sifted through screening trays made with different sizes of wire mesh. This graded the dirt the way gravel is graded at a quarry, showing the proportion of each size of particle.

Where the technicians found the soil well graded from fine to coarse particles, they had no worry. Where they found coarse sands and gravel only, they knew they needed a safety valve.

The reason the size of the soil particles was a telltale warning can be seen if you think of a drinking glass filled with buckshot. Just by looking at the glass you see that water will pass through the spaces easily. If you add BB shot, it partially fills the spaces and makes it more difficult for the water to pass. And if you keep on, adding first No. 7 shot, and then finer and finer particles, eventually you fill every crevice and cranny. At the end you still have a drinking glass full of shot, but water would find it much more difficult, if not impossible, to pass through under ordinary pressure. The same thing is true of the soil layers when water tries to pass.

But They Cost Too Much

Army engineers tried out the safety-valve wells five years ago, along the Ohio River. They worked. They relieved the pressure, and the levees held.

But right here they ran up against a second big problem: an economic one. The professional well-drillers shook their heads. A well 40 feet deep, with an 8-inch pipe and well screen, costs a thousand dollars. And hundreds of the wells were needed, in some spots as close as 150 feet apart.

Into the breach stepped Maurice Kirby, a young Middle Western geologist just branching out into the drilling business. He reasoned that the biggest expense in rotary drilling was not the drill work but the

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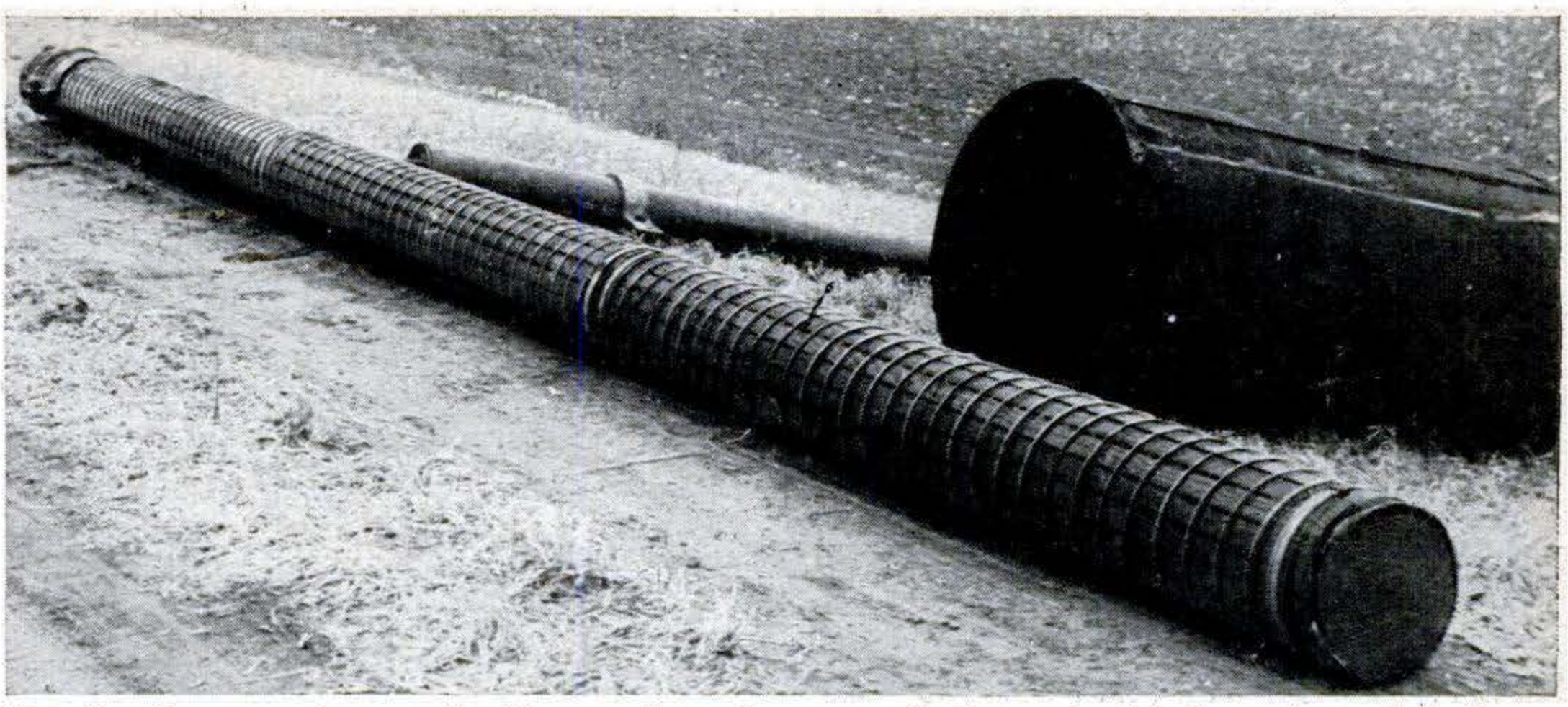

This is what goes into well. Creosoted-wood screen (foreground) connects to pipe (left background). Casing (right), formerly needed all way to well bottom, is now used only near surface.

casing—the protective lining that kept the walls from caving in. Every few feet you had to stop the drill, hoist the drill tools and drill head, put down temporary casing, then reassemble the drill stem and cutting head and start again. If he could find some way to keep from stopping the drill until the well was finished, he could do the work in less than a third the usual time.

To understand his solution, you have to know something about drilling. In ordinary rotary drilling, a bit is kept turning in the ground. A powerful pump forces water down through the hollow drill stem to the bottom of the hole, picking up the dirt ground away by the drill bit, and washing it up to the surface. But in going its turbulent way to the surface, the stream of water damages the sides of the well, and the temporary casing must be installed to keep it from caving in. That's why it's necessary to pull the tools, and stop the drill.

Kirby reasoned that if he could prevent the turbulent flow of the water, and just let it stand or flow gently, the walls of the hole might stand without the temporary casing. This was, in fact, an old method called reverse-flow rotary drilling, considered obsolete and almost forgotten.

Kirby tried it. First he reversed the flow of the pump in the hollow drill stem. Instead of forcing the water out through the drill point, the pump sucked. By building a sump near the site of the well and connecting it by a small canal to the well hole itself, water flowed gently down to keep the cavity filled. By this reversed flow, the water and drill cuttings were drawn up within the protective drill stem where they could do no harm, and returned to the sump.

Then came a very nice touch. If you made the sump hole the right size, the cuttings just backfilled so that when the well was completed, the sump was filled.

Kirby backed his idea with his own money. Last year he bid on the first installation of wells along the Missouri River near Kansas City at a third the anticipated price. And the first few wells proved his judgment correct. Drilling a well this way took an hour—the old method used up the best part of a day. And the cost was brought down to around $300 a well, including the screen, well pipe, and concrete well pit.

And They Really Work

These underseepage wells have already had their baptism. In the spring, a record flood mounted the levees. The dwellers of the lowlands were dubious. Those levees had failed in other years. Some people moved stock and perishables to high ground.

But as the river water rose, the water in the pipes rose with it. As the pressure built up, the wells discharged a little water, and pressures were immediately relieved. No levee protected by these wells failed.

Now contracts are being let for similar wells behind other levees, and some 500 miles of dangerous levees in the Missouri basin will be protected. All the drilling contractors are using the reverse-flow method that Kirby resurrected. In fact, this same type of well is being installed as protection below dams where ten million tons of dirt will hold back ten billion tons of water. END

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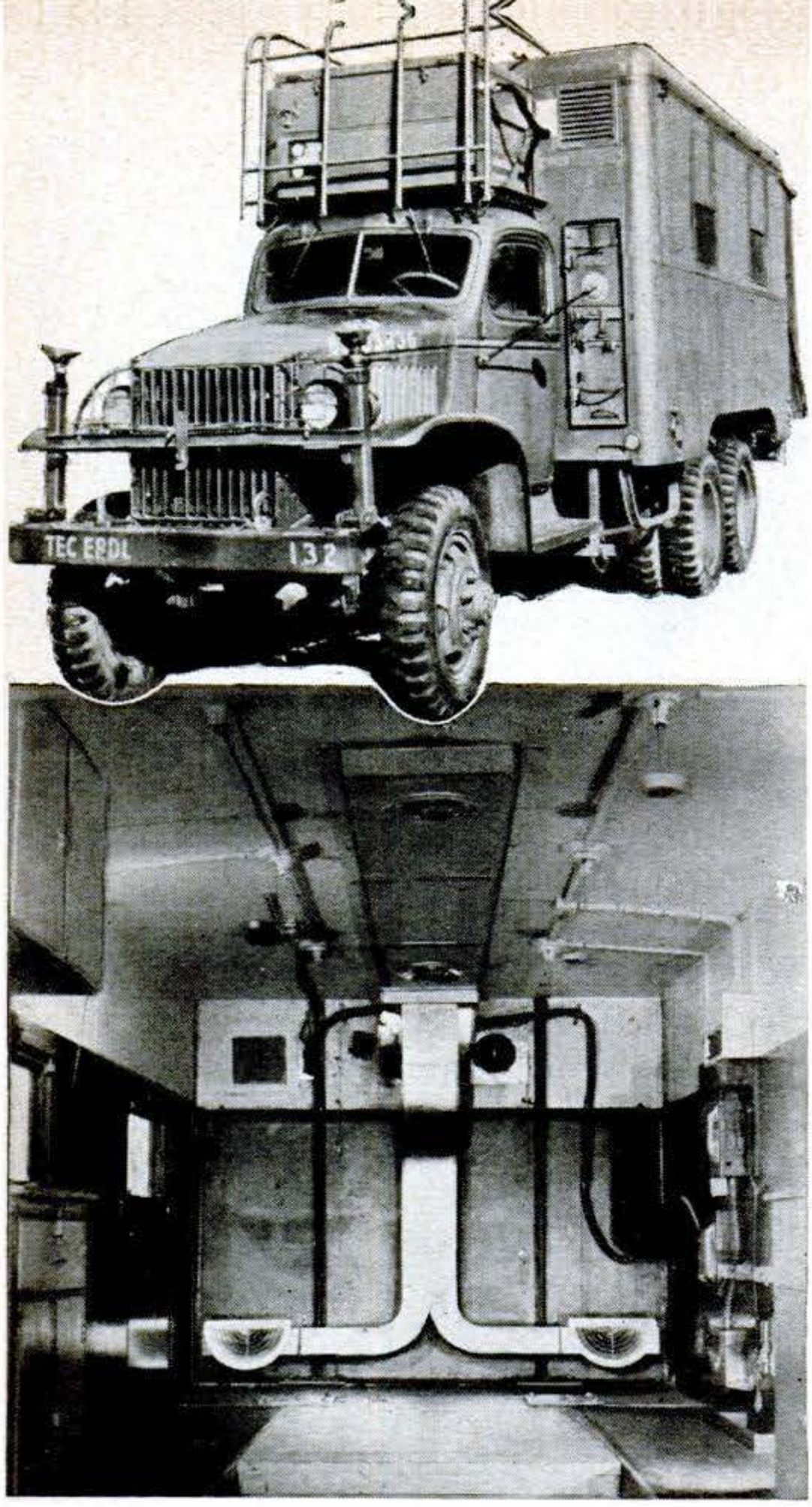
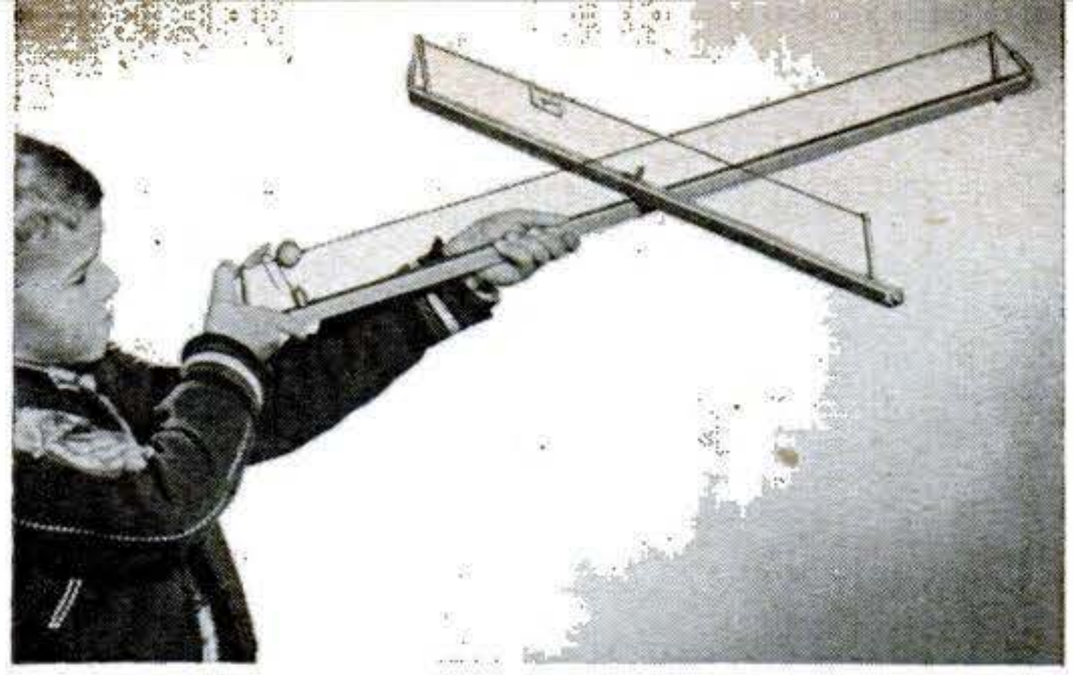


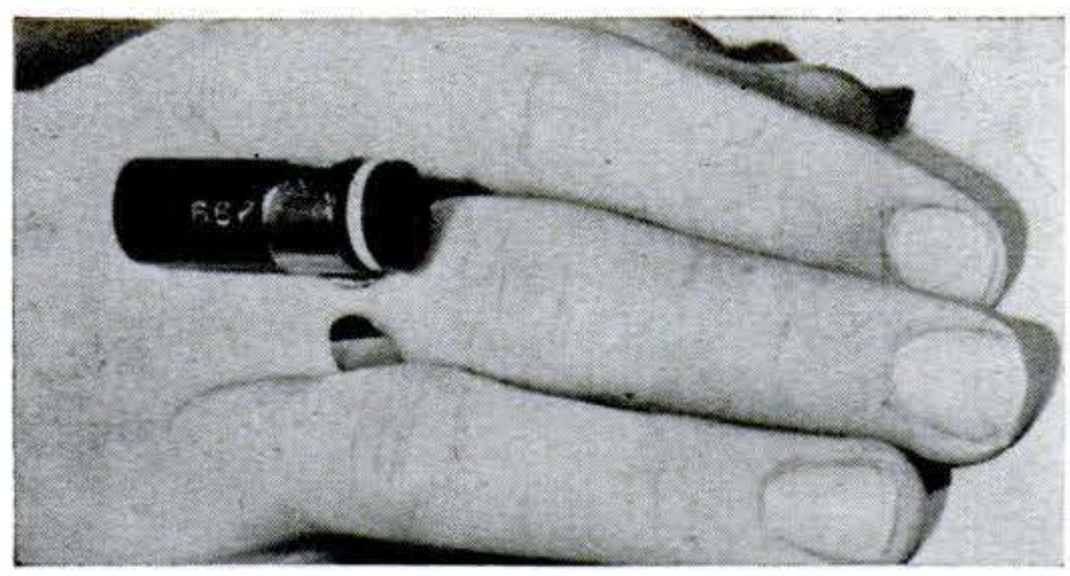


"Skeet" Toy Shoots Sliding Duck

TILT this Wing Shot toy sideways, and a metal "duck" scoots along a wire on a crossarm. Press a trigger, and a spring-propelled "bullet" zips forward along another wire. With a correct "lead," the target will be hit and spun around. Since both bullet and target stay on their wires, Junior can bang away to his heart's content without damage to himself, the furnishings, or parents' nerves.

Van Heated for Arctic Map Making

FOR making lithographed military maps in the Arctic, Army engineers at Fort Belvoir, Va., have developed the special van at top above. Regardless of outdoor cold, an interior duct system (lower view) circulates gasoline-heated air at the constant temperature and humidity required by chemicals and equipment employed.

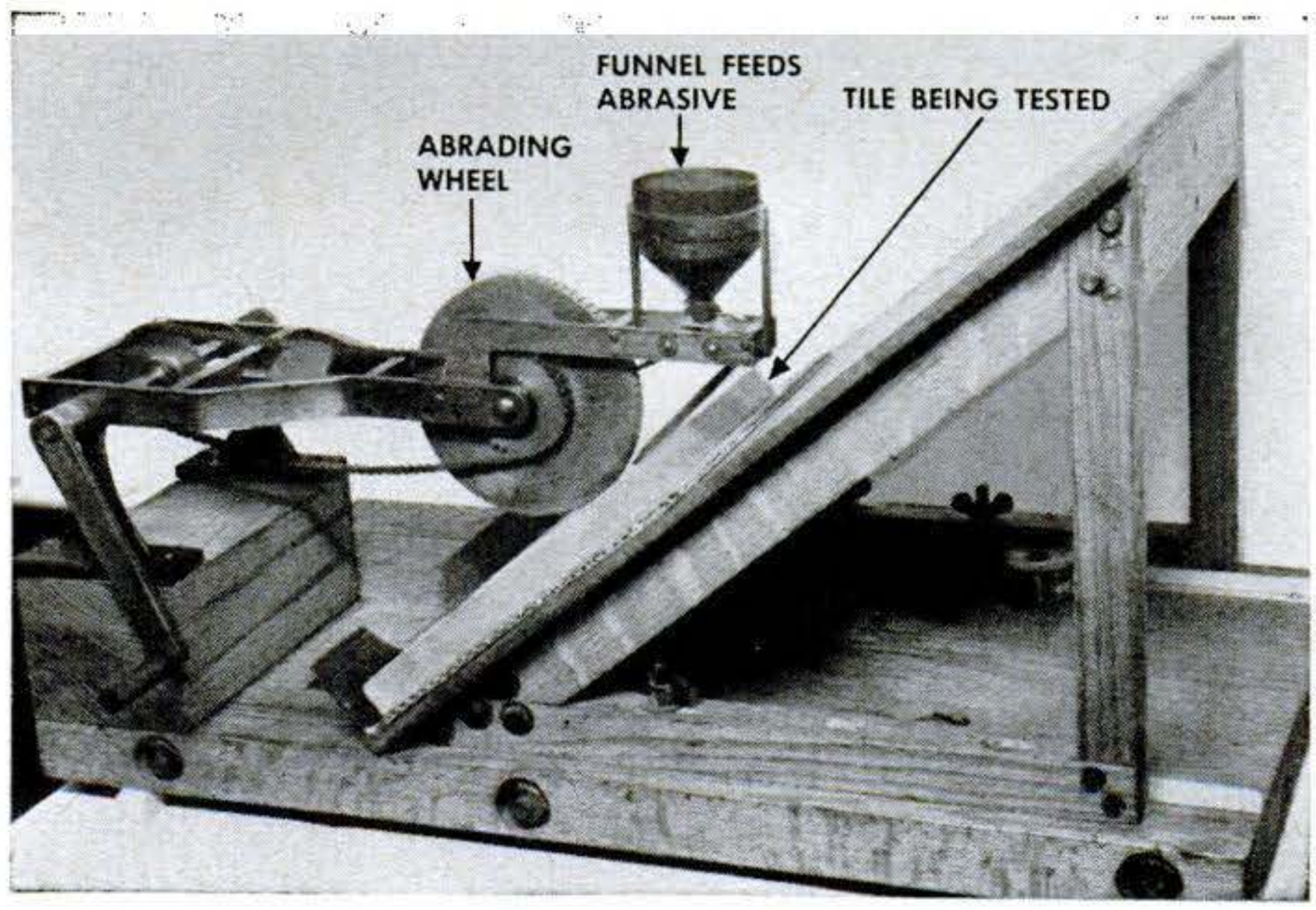


Finger Meter Warns of Rays

WORN on a finger ring by a worker handling radioactive materials, the midget Landsverk meter above warns when his hands have received the maximum permissible amount of radiation. For reading, it is inserted in an auxiliary battery-operated instrument. Measuring 1 9/16 in. long, the plastic meter weighs only 1/5 ounce.

Test Predicts How Floor Tile Will Resist Wear

FLOOR tiles of different resistance to abrasion will wear unevenly under heavy usage. To avert this in government buildings, tile is first tested with the National Bureau of Standards apparatus at right. A revolving steel wheel, fed with corundum abrasive from a funnel, grinds a groove in a tile. The length of the groove measures abrasion resistance, for selecting tile of uniform wearing quality.



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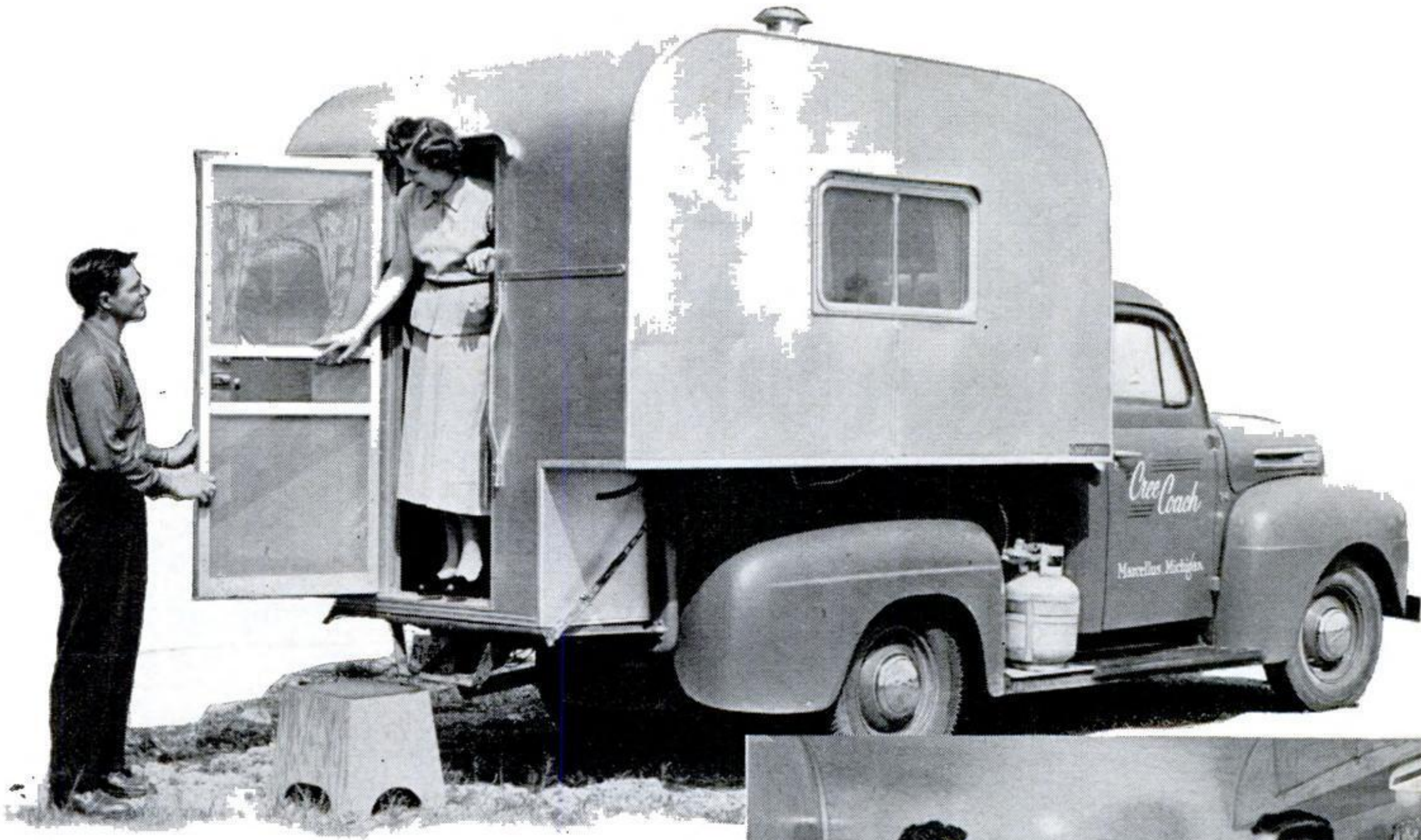

Home on wheels for tourists and sportsmen is coach that rides on truck. Driver can look clear through structure and out window in rear door. Container on running board holds cooking gas.

Traveling Home Rides on Truck

SLIDE this miniature home on a pickup truck, bolt it down, and you have a "houseboat on wheels" for vacation travel. Called the Cree Coach, it gives the equivalent of a car and trailer in one unit, and applies Pullman-style design for comfort.

It has cushioned seats for four and sleeping accommodations for a couple, plus a canvas-bunk upper berth for another sleeper. A kitchen provides a bottled-gas range with an oven, and an icebox and sink. Closets and lockers give ample storage space.

Sheet aluminum covers the exterior, and varnished plywood the interior, with fiberglass insulation between. The coach has ventilation openings on all four sides, and also an adjustable roof ventilator.

Only half an hour's work transfers the rolling home, if desired, to concrete blocks or four-by-fours at a resort site.

Two models are made by the Cree Trailer and Boat Co., Marcellus, Mich.—the eight-foot, 850-pound one described and pictured here, and a 10-foot model equipped with an electric refrigerator. END

Pullman-style interior becomes dinette. Meal is served from kitchen in right foreground. In daytime arrangement shown above, comfortable deep-cushioned seats accommodate party of four.

At night, seats turn into a double bed of generous 6½-foot length. There's room for a third sleeper in canvas bunk above. Design of interior allows six-foot, two-inch headroom.

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STAGE

ORCHESTRA PIT

GUIDE BOOM

TRACTION MOTOR

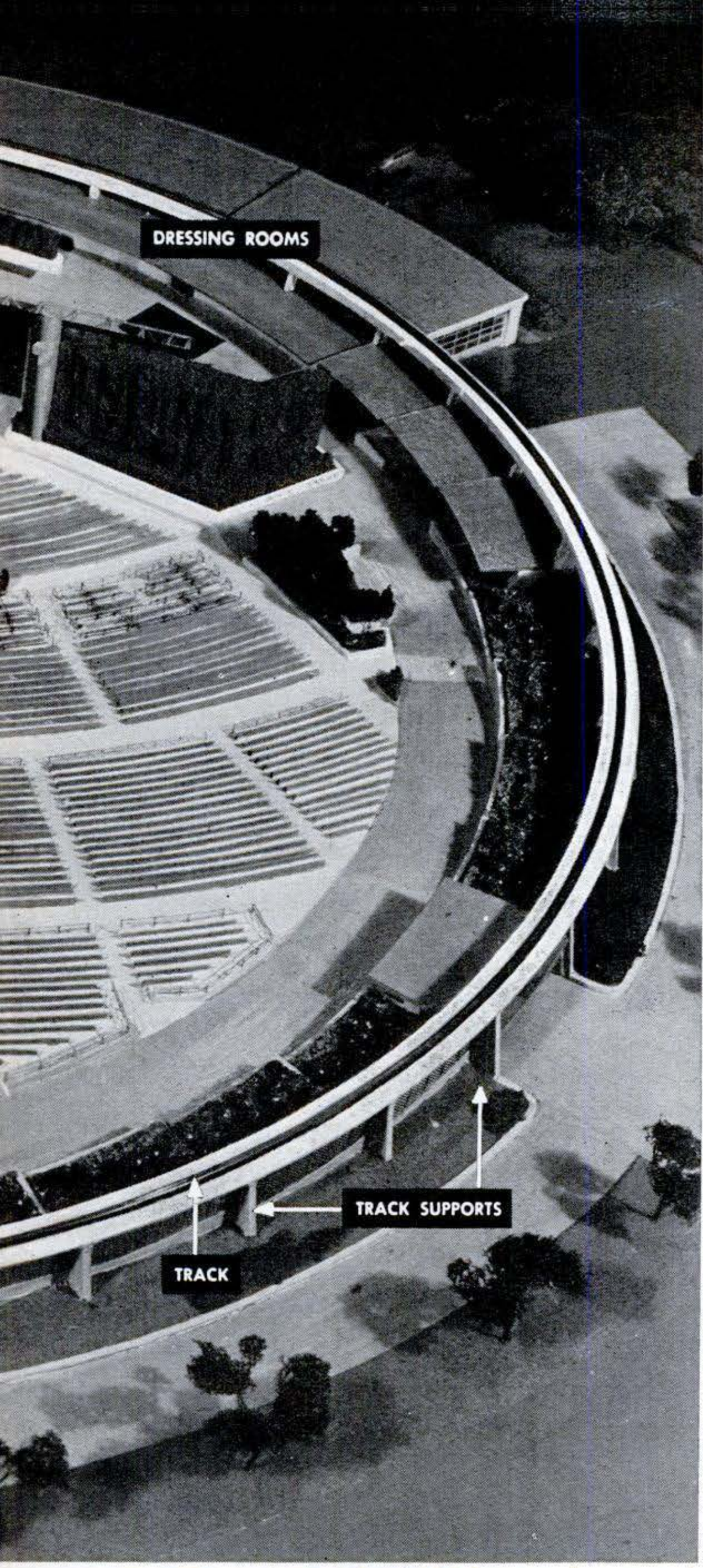
GUIDE BOOM

CANTILEVER TRUSS

TRACTION MOTOR

MAIN ENTRANCE

Architect's model shows cantilever truss extending to center of amphitheater high above the audience. Steel booms pulling the leading edges of roof will be propelled by two 50-hp. **The central control booth,** suspended from the cantilever beam, will house operating mechanism for the roof, as well as sound and lighting equipment for the stage.



motors running on the 1,200-foot track mounted on a wall surrounding the theater.

Moving Roof Covers Theater

Showers won't dampen the enjoyment of music lovers attending performances in this unique open-air theater.

By Richard Giovine

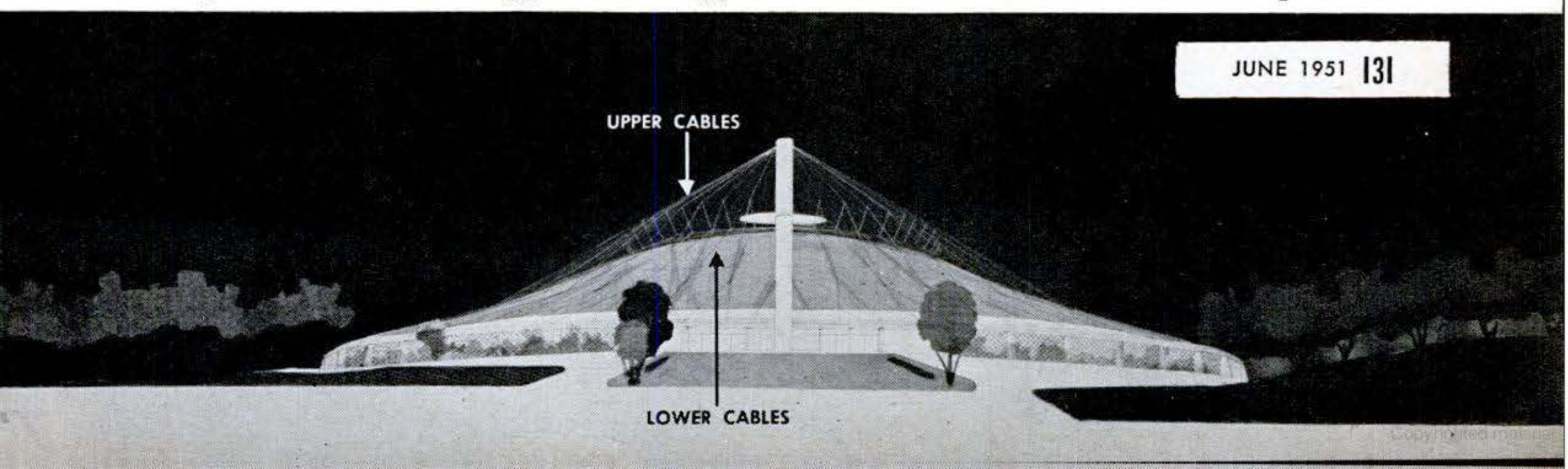
THE world's largest umbrella may soon provide rain-insurance for music lovers attending outdoor performances of the Pittsburgh Civic Light Opera Association.

To solve the problem of costly rain-outs experienced in its present stadium location, architects have designed this unique amphitheater seating 9,500 people. It has a flexible plastic roof that will fan out to a diameter of 370 feet and cover the entire audience and stage within less than three minutes after black rain clouds begin to gather.

A giant cantilever steel truss, extending from the rim of the theater bowl, will terminate high above the crowd in a center mast to which supporting cables are attached. Traction motors, mounted on a track running along the top of the surrounding wall, will pull and guide two rigid booms that are secured to the leading edges of the fabric. A 15-foot-wide circle of gardens will catch rain running off the plastic roof. When not in use, the roof will be folded out of sight of the audience over an area to be used as a main lobby.

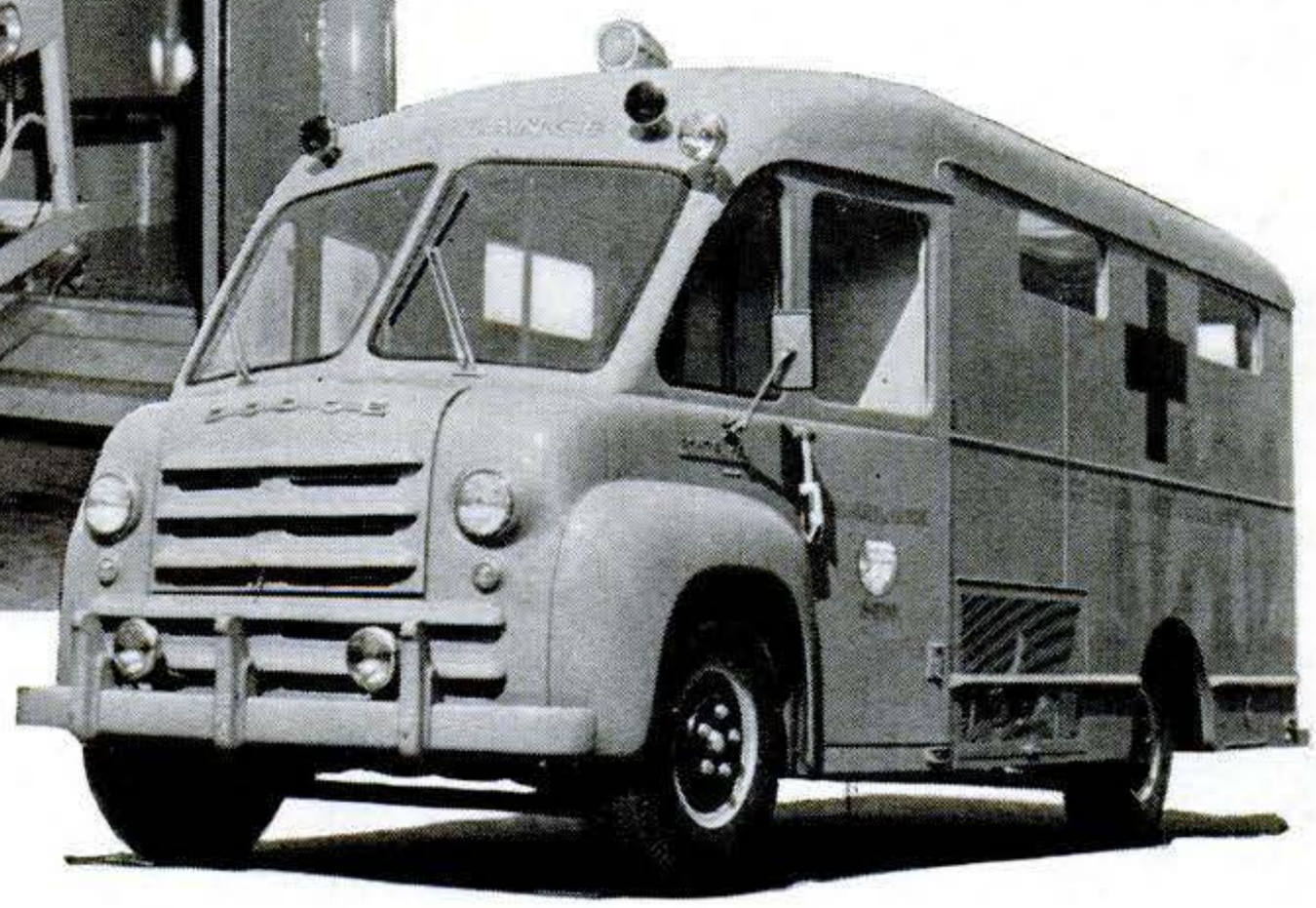
The idea was conceived by a firm of Pittsburgh architects, Mitchell and Ritchey, who say that actual construction now awaits the availability of materials. The project is expected to cost about $1,750,000. END

Dual-cable system to protect against wind damage is shown below. Upper cables support dead weight of roof and resist outside winds. Lower cables resist internal wind pressures.

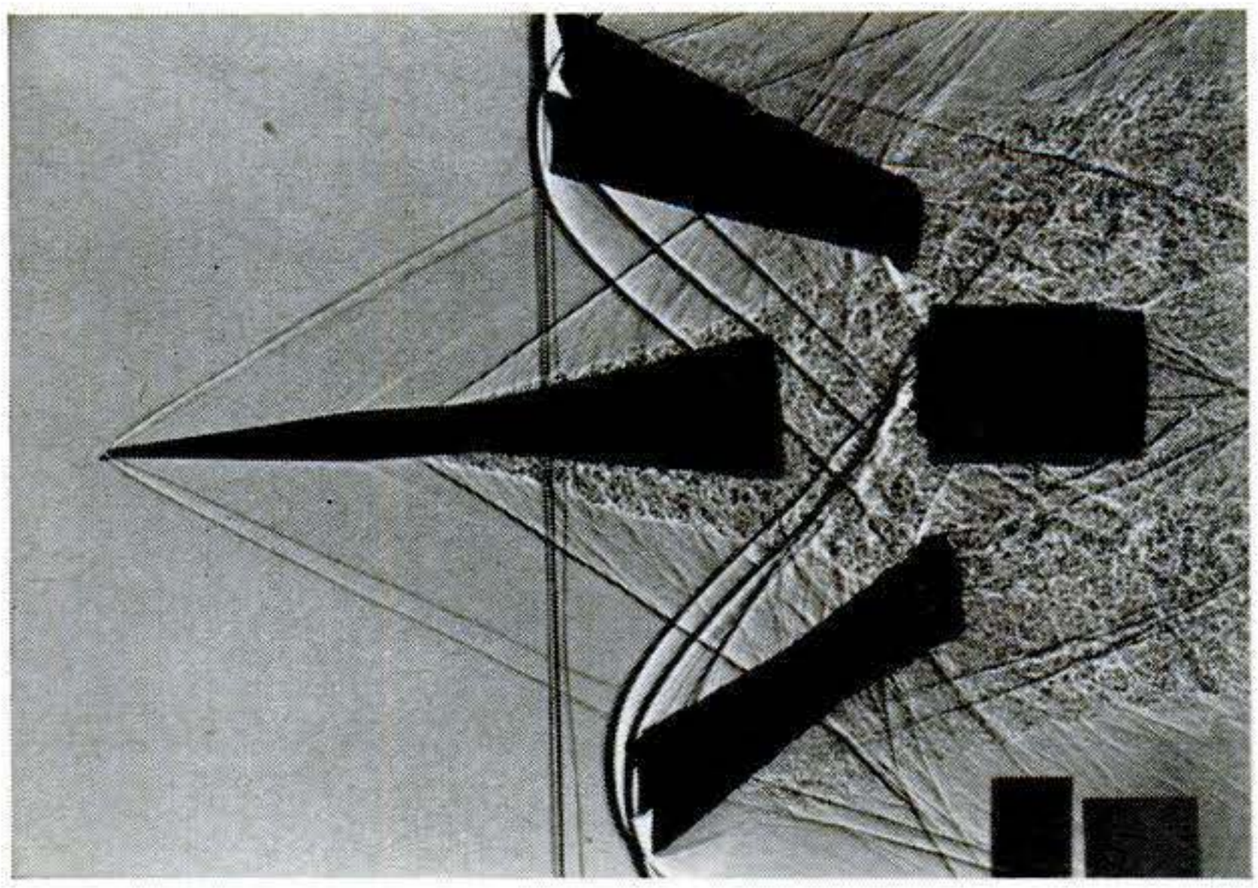


Special Van Moves Polio Victims

THE first van built for the special purpose of transporting polio patients in an iron lung was put into service recently by the Los Angeles County General Hospital. The vehicle can be stripped of its polio equipment in a few minutes and converted into a 14-litter ambulance.



Carrying its own generator for iron lung, the van, designed by Dodge engineers and hospital staff, was built by Standard Carriage Works. As litter ambulance, it is largest in U. S. civilian use.



Missile Pictured at 1,500 M.P.H.

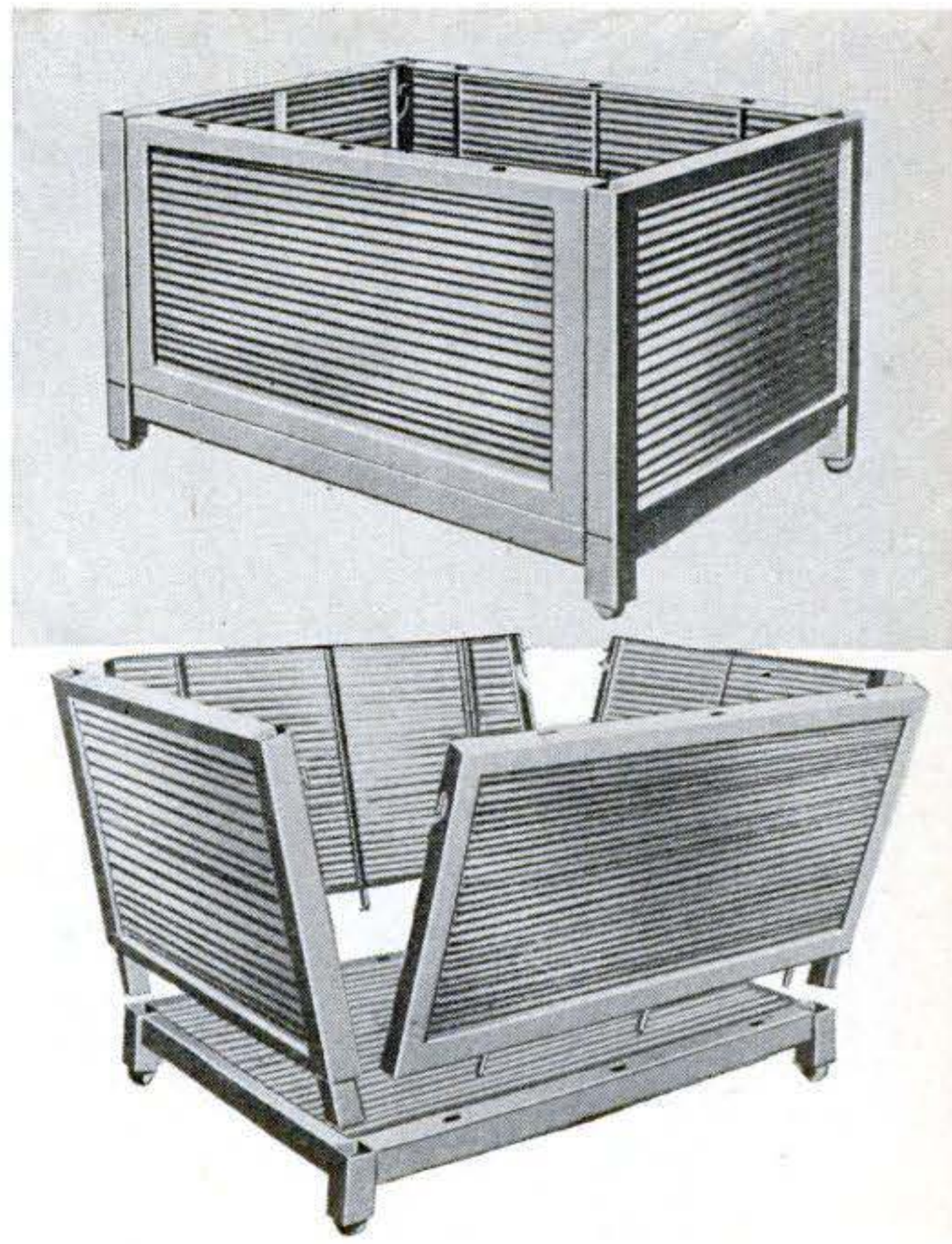
THE pointed missile model at left snapped its own shadowgraph by breaking fine wire (bisecting photo) at a speed of 1,500 m.p.h. It was fired against a supersonic air stream in a wind tunnel at NACA's Ames Laboratory, Calif., (PS, Oct. '50, p. 144). Dark lines streaming back from the tip of the model are supersonic shock waves; the three black patches behind show the breaking up of a plastic carrier used to protect the missile from the firing blast; and the bubble-like pattern is turbulence.

New Lens Marks Airport Runways

A NEW kind of airport runway light has a lens that does the work previously requiring two or more lenses. Made by Westinghouse, it is described as an oversized thimble. Two flattened sides send out powerful beams to outline the runway. One curved side faces away from the runway to distribute light from the 200-watt bulb in a fan to indicate to circling airmen the direction and orientation of the runway. The other curved side of the lens gives a glare-free glow to mark the runway margin without interfering with the pilot's vision as he comes in for a landing.

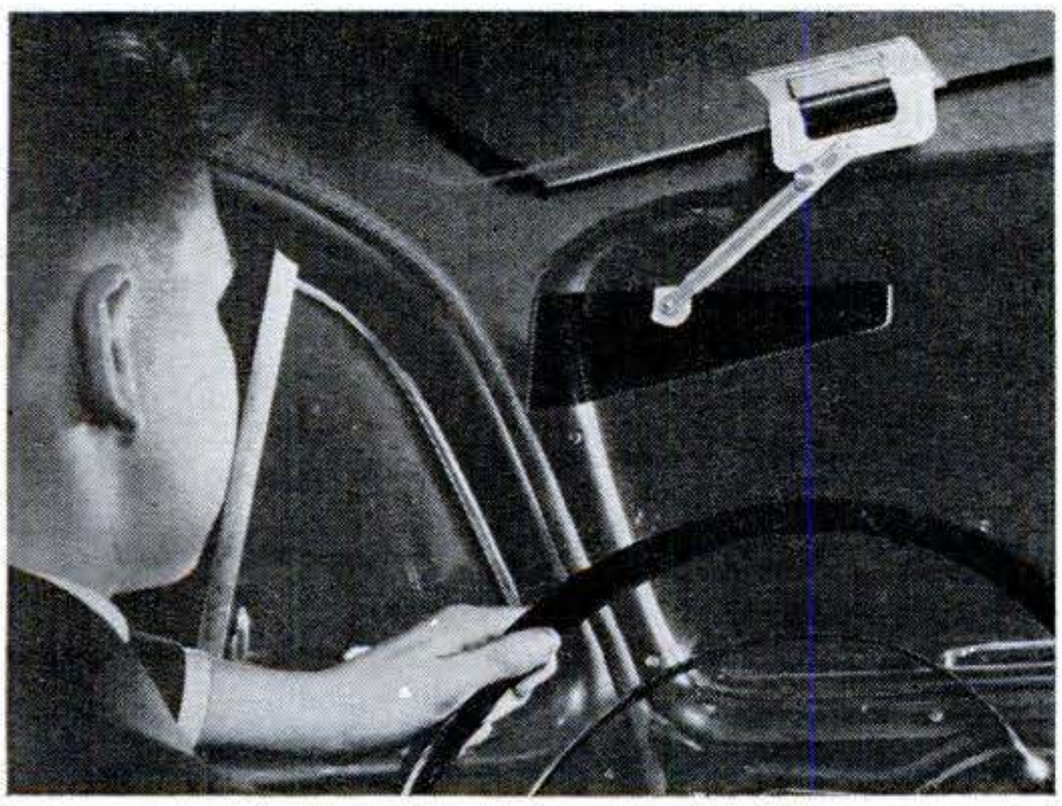
Tray Holds Paint for Roller

THE flat pan shown attached to the ladder above lets you apply paint to a roller without spill or drip. Just dip the applicator into the deep end of the pan, roll it toward you, and squeeze excess paint off at the shallow near end. The aluminum tray, made by Thomas Products, Detroit, is clamped to the ladder. A chain holds the end.



Knock-Down Boxes Save Space

REMOVABLE sides of these new steel boxes for handling materials enable them to be returned empty in a fourth the space they took when shipped full. Because the boxes are easily picked up by fork lifts, their bottom pieces can be used alone as pallets. Made by the Jarvis B. Webb Co., of Detroit, the units can also serve as storage bins.



Eye Shield Cuts Driving Glare

THIS colored Plexiglas eye shield, which clamps onto any car sun shade, is designed for safer night driving. The motorist retains a full view of the road. To screen his eyes against oncoming headlights, he simply raises his head slightly. Manufactured by the Pocono Sales, Service & Supply Co., Delaware Water Gap, Pa., it's priced at $3.45.

Self-Cleaning Rake Saves Stoop

FOR the person tired of up-ending a rake to clear its teeth, this Self-Kleen Rake simplifies the job of cleaning up the grounds around a house. When forward pressure is put on the handle, the spring-loaded teeth bend under as shown, and friction with the ground removes debris. It is marketed by Arthur Paul Sales, Green Bay, Wis.

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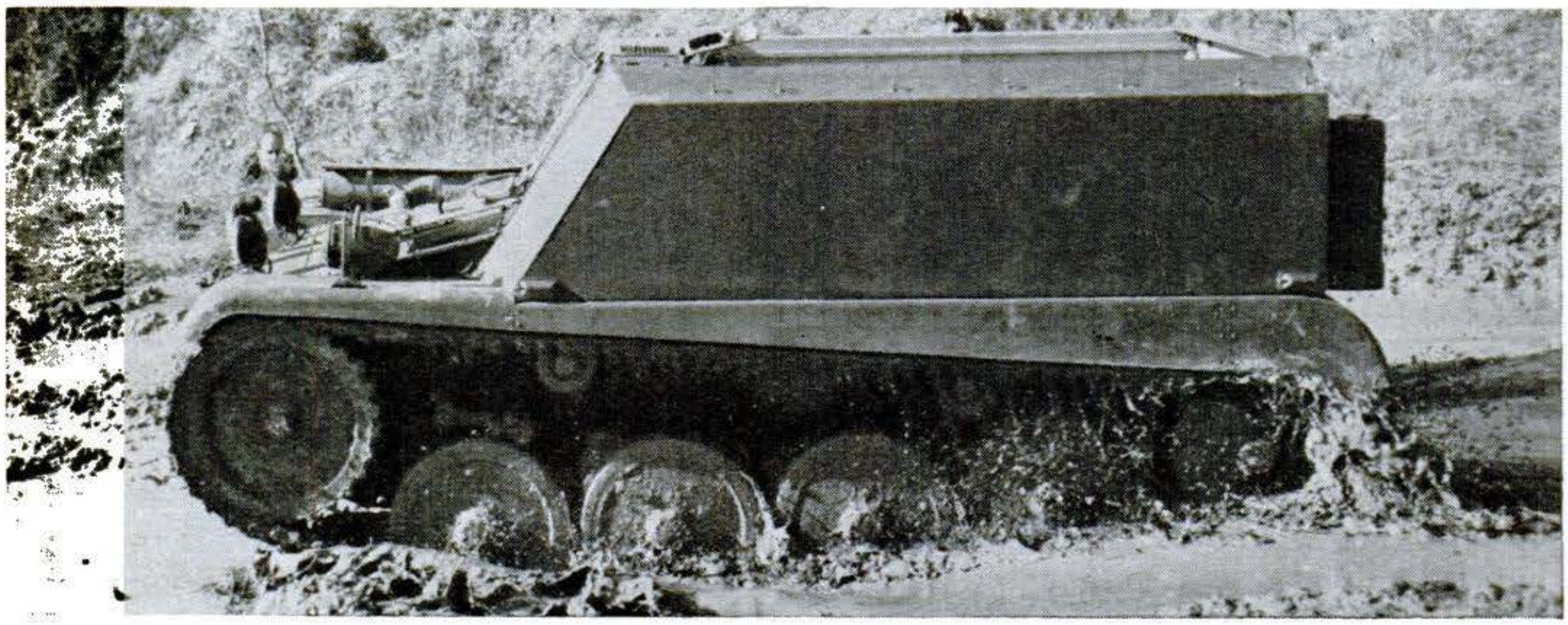
France Shows Its New War Weapons

Fifty-ton heavy tank of 1,000 hp. has speed of 30 m.p.h. Shown here with 100-mm. gun, it's new French rival of Russia's "Joseph Stalin III," England's "Centurion," and America's "General Patton."

A NEW 50-ton tank, soon to be sent to the U.S. for study, is called by its French builders the first to outmaneuver the Soviet Stalin type. Carrying a 100-mm. or 120-mm. gun, it performed impressively at 30 m.p.h. for Allied military observers in a recent demonstration of the latest French war weapons. Other highlights were new French versions of bazookas and recoilless rifles, the antitank weapons heavily relied upon to stem waves of Red armor.

Under Western defense plans, France will supply the bulk of the land forces, and the demonstration showed what she could contribute to equip them. Military experts coordinating the Allied effort have already approved some of the new weapons for mass production in French factories.

Weapons carrier of one-ton capacity can be parachuted from plane. Tracked chassis enables it to plow through mud, sand, or snow. Light armor protects against small-arms fire.



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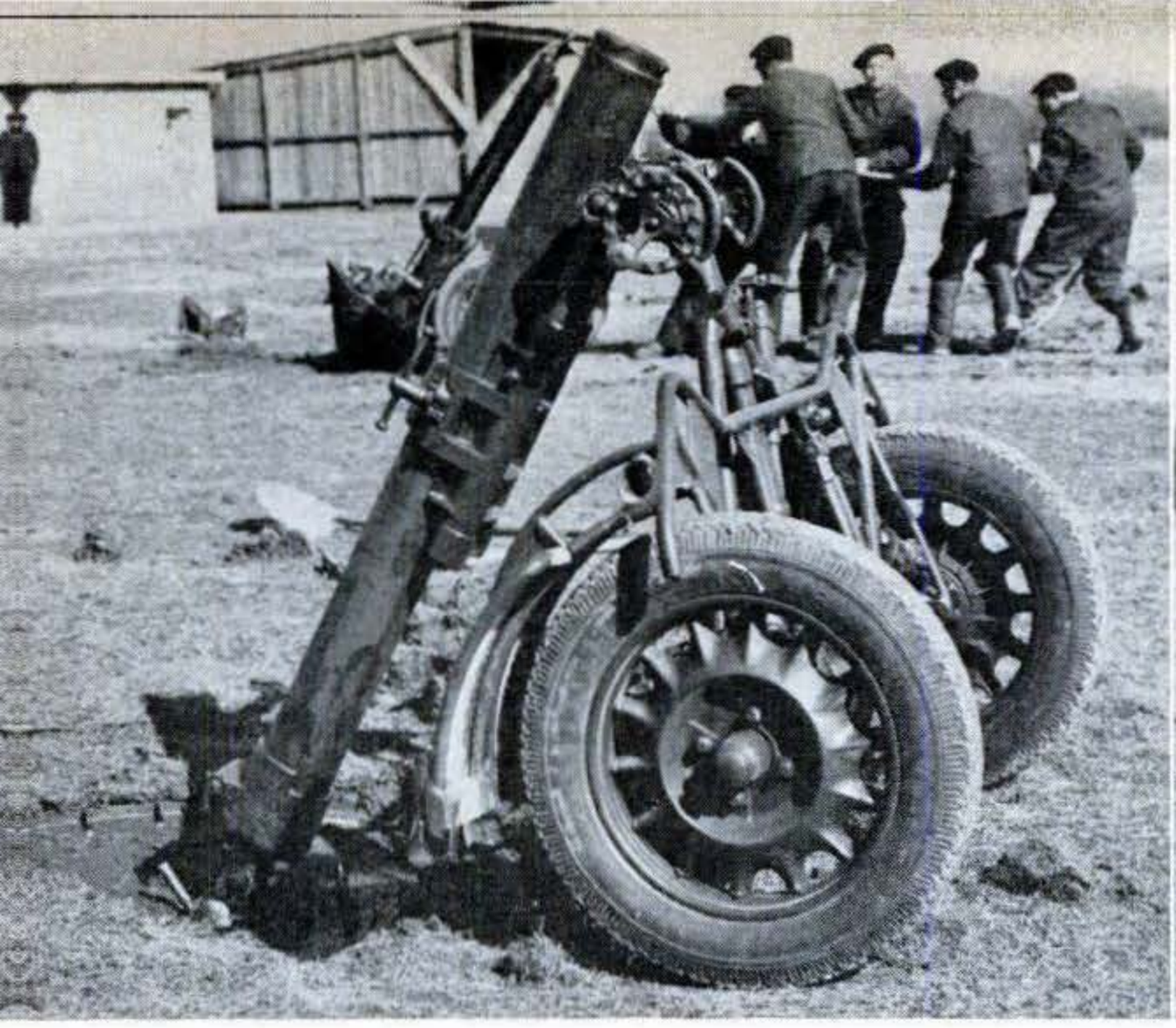


New 120-mm. mortar, on pneumatic-tired wheeled carriage for mobility, hurls a 28.6-pound projectile. It has a range of four and a half miles, and can be fired at the rate of 10 to 12 rounds per minute. Caliber is between that of U. S. 105-mm. and 155-mm. types.

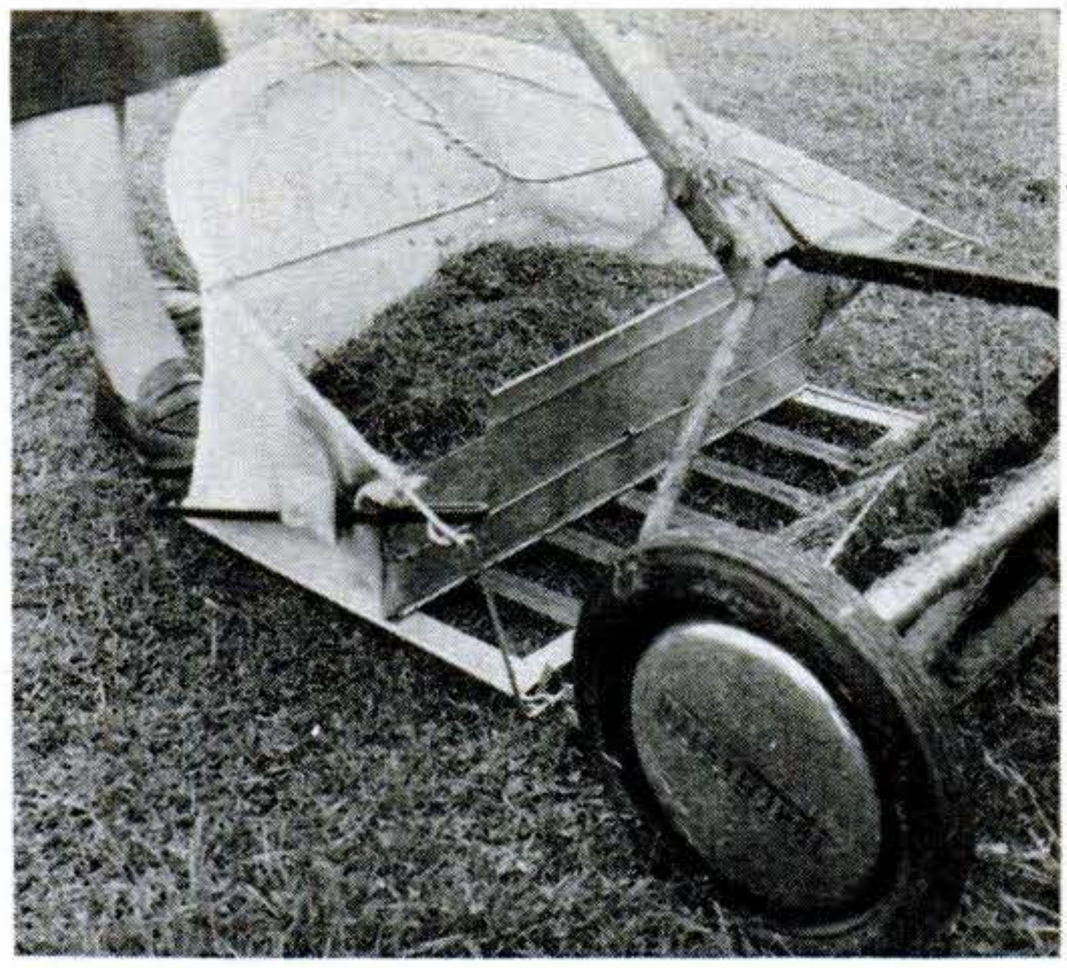
"Mystery weapon" is the one above, also seen being handled with rope through eyebolt by crew in background of view at left. Brief data received with photo call this another type of 120-mm. mortar, despite unconventional appearance and lack of any visible traversing mechanism.

Featherweight bazooka, one of new French arms approved for mass production under North Atlantic Treaty, weighs only 11 pounds, has 400-yard range. It fires rocket with caliber of 73 mm., or 2.87 in. (U. S. types are of 2.36-in. and 3.5-in. size.)

French version of 75-mm. recoilless rifle, powerful weapon introduced by U. S. late in World War II, is 154-pound gun below for airborne troops. Two men can carry it. One well-placed shot can knock out heavy tank. END

'Hamburger Express' Speeds Service

PATRONS of this Chicago short-order restaurant can enjoy, simultaneously, two favorite pastimes—eating and model railroading. A toy electric train, running on a large oval track, delivers food from the kitchen to a self-service counter. A waitress at the control switch stops it where each customer can unload his own order. Flatcars carry food platters, while gondolas transport cups of mustard and ketchup.

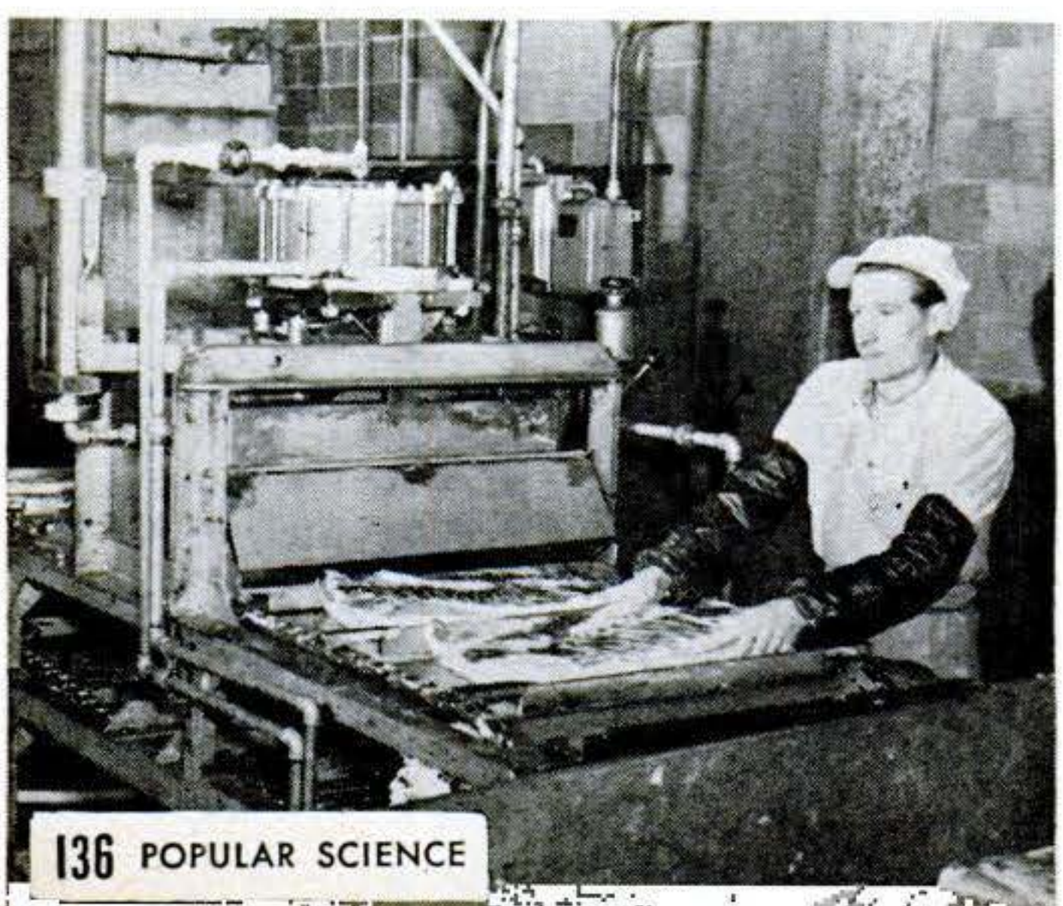


Footwork Saves Back-Bending

YOU can pile more grass into your lawnmower basket, without bending over to push it back, if the grass catcher is equipped with this pedal-operated stacker. Pressing a pedal in back tilts the galvanized-iron throw plate up and back, tossing cut grass into the back of the basket and leaving room in the front for more. Kircher Katcher Distributors, of Santa Clara, Calif., sell the outfit for about $4.

Machine Squirts "Age" into Bacon

THESE men are running slabs of fresh bacon through a new machine that cuts the curing time from two weeks to two days. As the slabs move along a conveyor, each pauses briefly under a press that jabs 101 needles into it and injects curing fluid evenly through the meat. Each needle is fed by its own cylinder and piston, while a master cylinder—at the top—adjusts the piston stroke to the thickness of the meat. The toughest problem Kingan & Co., of Indianapolis, had to lick in designing the machine was keeping the needles strong enough so they wouldn't bend or break, yet fine enough so they wouldn't leave holes.



Tiny Tractor Has Fluid Drive

OLD airplane wheels, a four-cycle gasoline engine, a power transmission from a bomber's machine-gun turret—and a father's ingenuity—are the main ingredients of this boy-size tractor. The transmission, linked to the engine and rear axle by chain drives, is a fluid coupling that is actuated simply by stepping on the accelerator. The only other control is the steering wheel. This makes the tractor so simple to operate that 3½-year-old Dwight Lohrenz, whose father built it, can drive it safely on the sidewalks near his Long Beach, Calif., home. Pop's only help is pulling the starter rope and acting as traffic cop on occasion.

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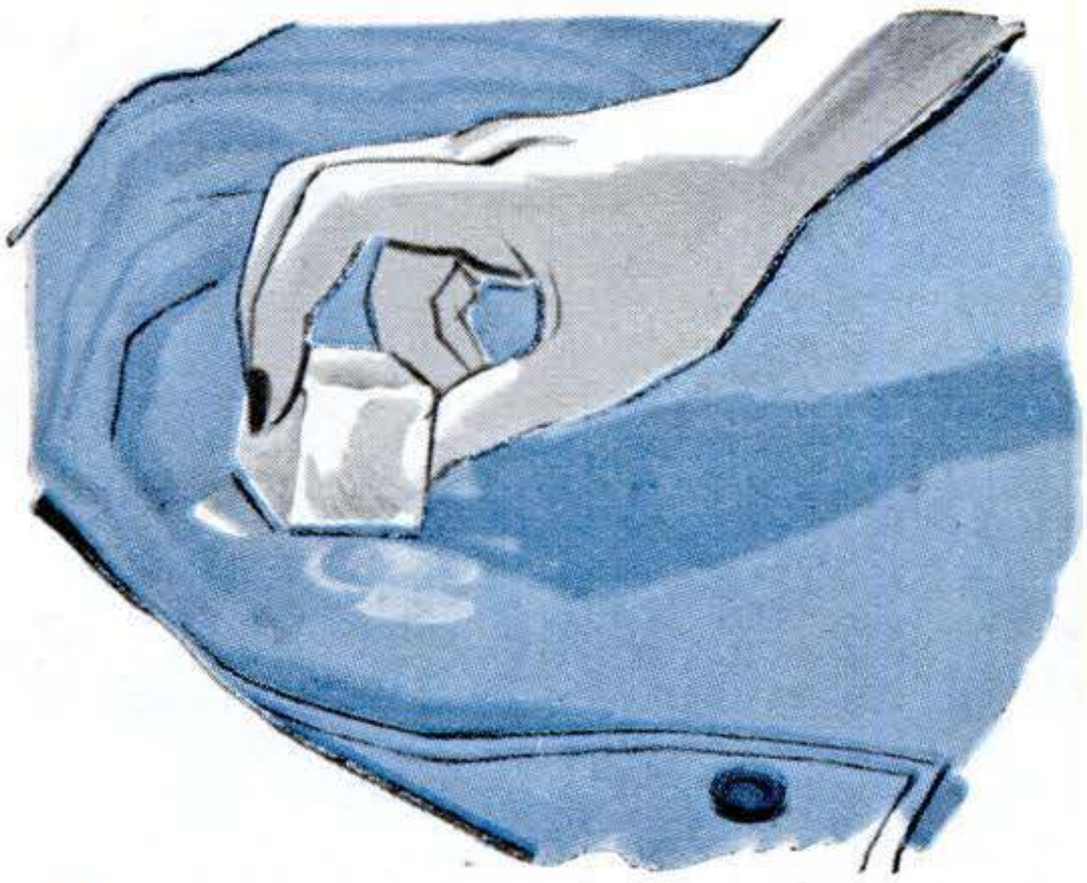
Keeping the Home Shipshape

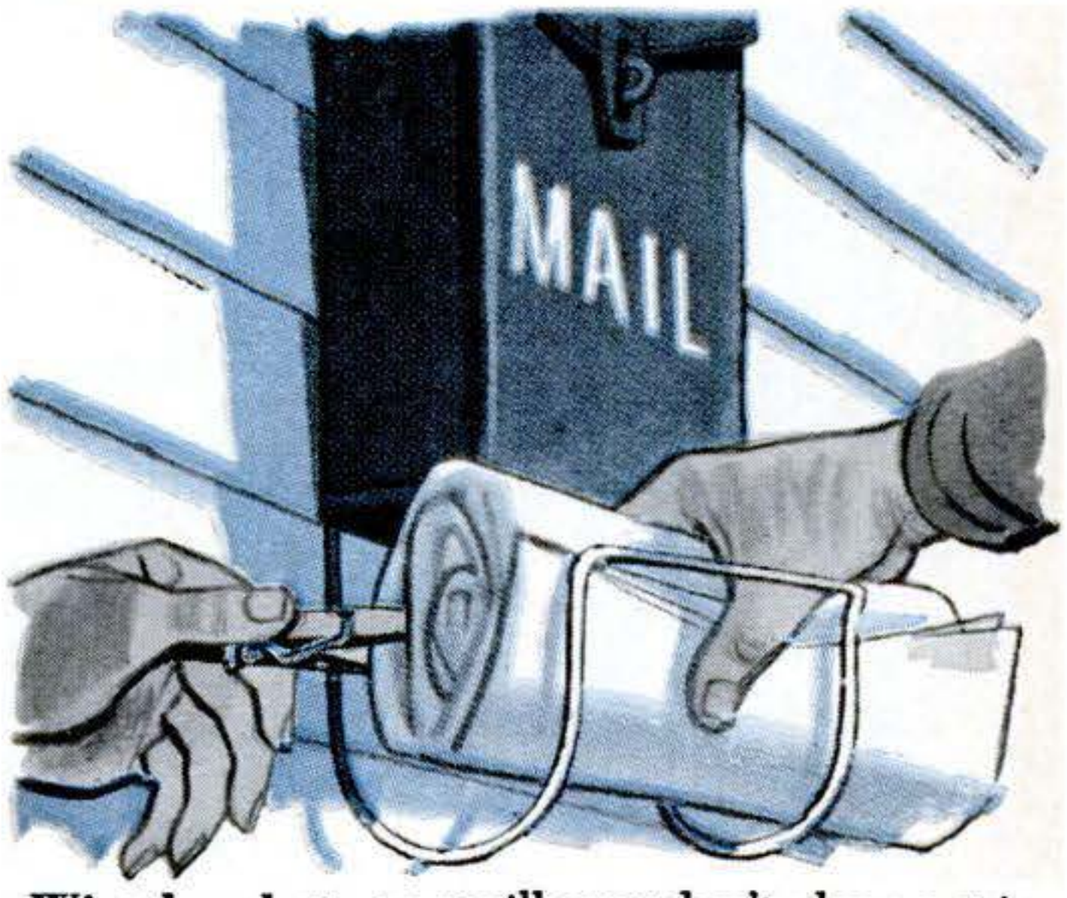
If you and your neighbors have identical door chimes, you may find it hard to tell from the yard when yours goes ding-dong. Reverse the tubes so yours will go dong-ding instead.

When plant rows are marked with empty seed packets, the paper packets soon become weathered and torn. Slip a transparent cellulose sandwich bag over each one to protect it.

You can convert a studio couch into a sofa. Build a box the length of the couch and about 10″ wide. Hang it on the wall just above the couch and rest the pillows in front of it.



To remove chewing gum from clothing, rub a piece of ice on the wrong side of the material. The ice will chill the gum and then you can lift it off with less trouble.



Wire brackets on mailboxes don't always grip newspapers tightly enough to prevent them from blowing away. A spring clothespin clipped to one wire will hold such mail.

Please turn the page for five more suggestions.

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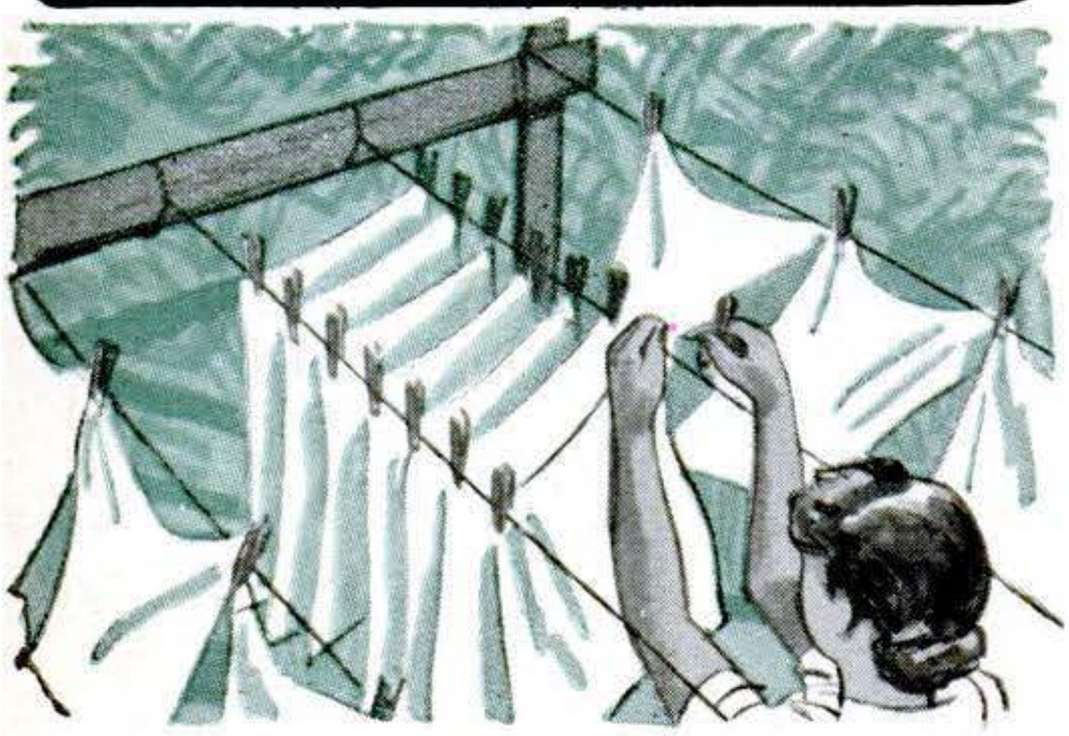
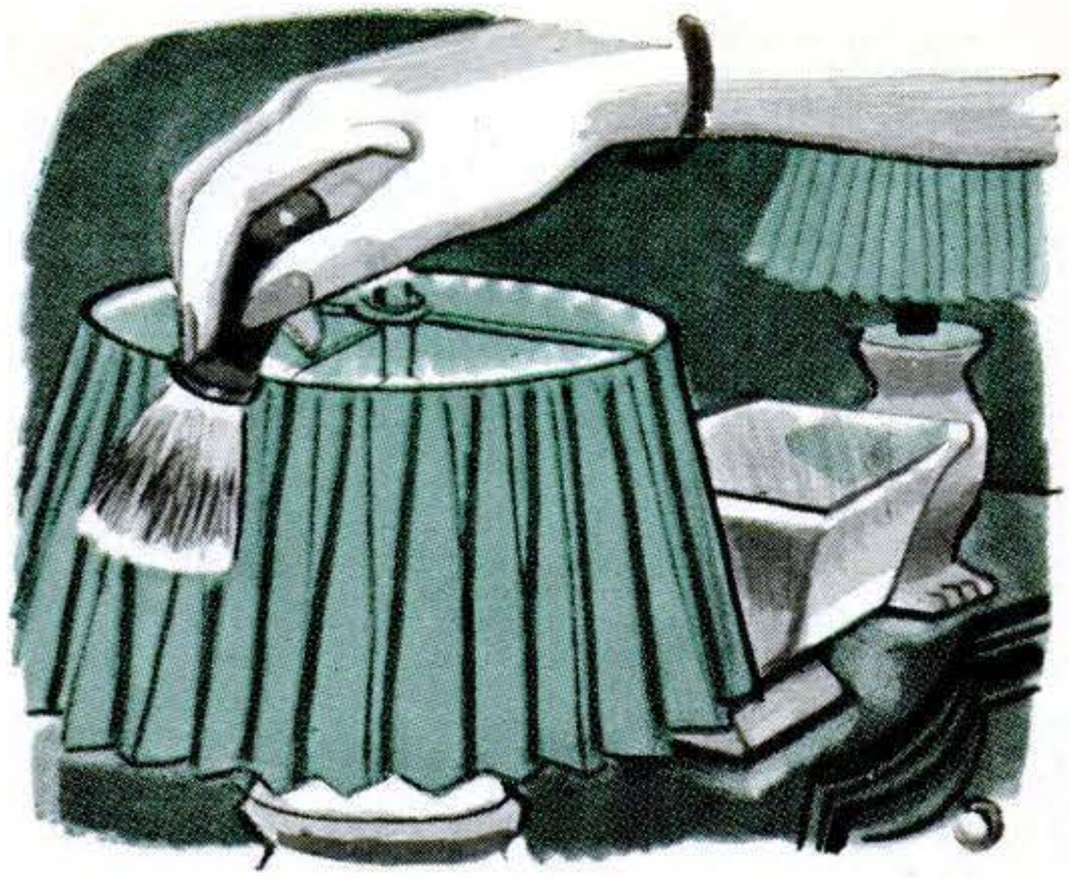
Keeping the Home Shipshape

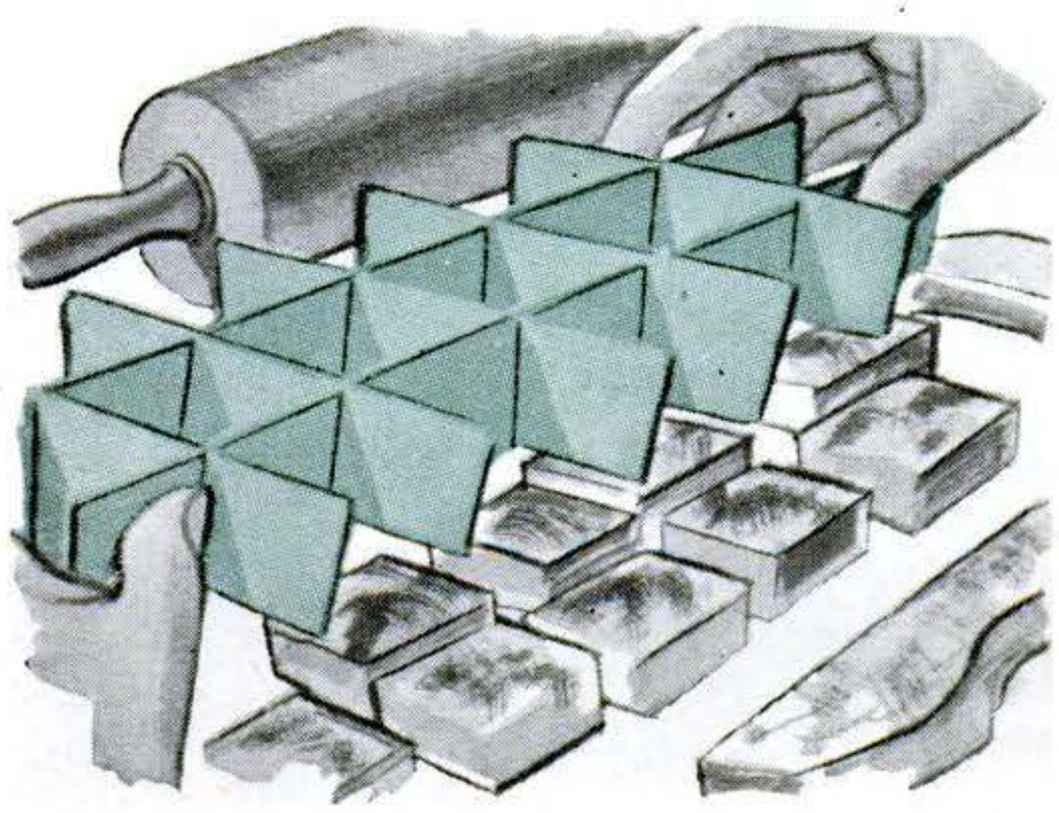


If you have a baby in the family, rig up a wash line as shown. It holds more diapers and baby clothes than one long line. Items pinned crosswise should be about six inches apart.



A discarded shaving brush makes an excellent duster for fragile objects such as pleated-silk lampshades, or for hard-to-get-at dust in elaborately carved or grilled furniture.

To rip seams, clamp the material on one side of the seam under the foot of your sewing machine. Put tension on the seam with the left hand and snip stitches with the right.



You can save time when cutting biscuits by using the metal ice-cube divider from your refrigerator tray. You'll have a whole panful of even squares in one easy operation.

Use cellophane to tie plants to stakes. Pieces about 4" by 10", folded into 8-ply strips ½" wide, make strong cords that are transparent, waterproof, and nonchafing to plants.

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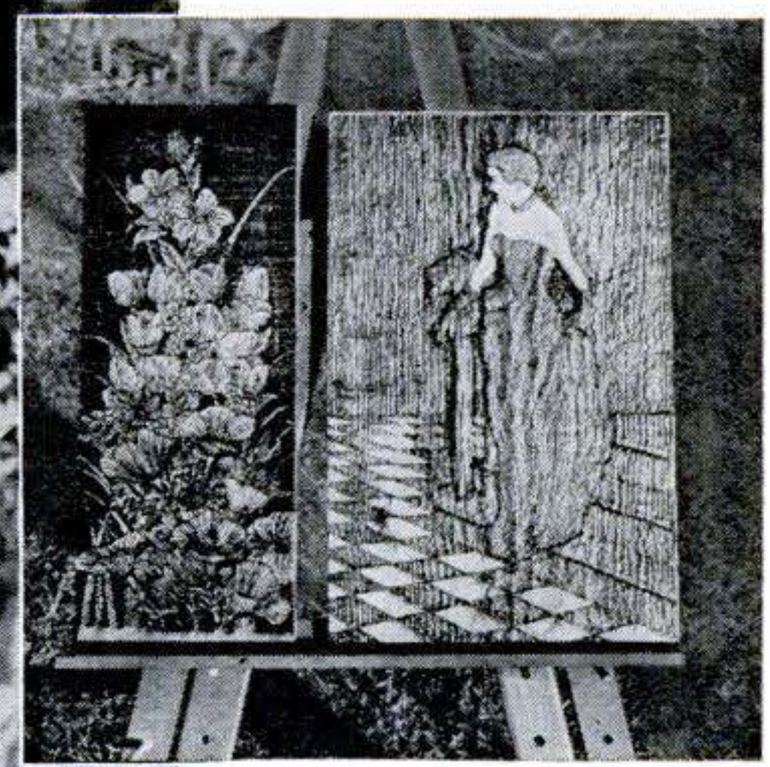
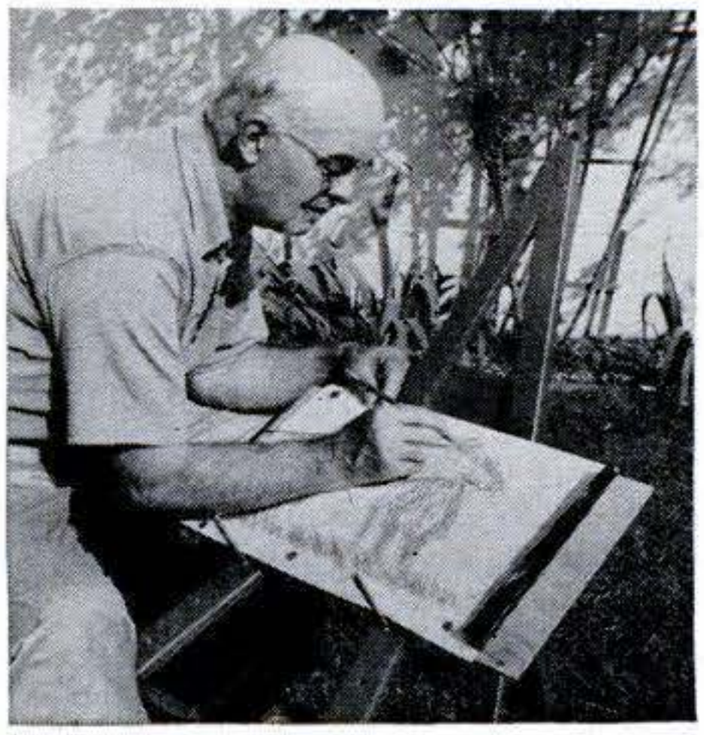


Decorating wood by sunburning alone, or by first tooling and then burning it, is a satisfying, inexpensive hobby, says R. A. Wallingford, left, of Monterey Park, Calif. Above are two of more than 1,300 pieces he has turned out. Goggles protect his eyes from the blinding sun spot, and gloves guard his hands from occasional flame. To outline a drawing, he uses a large magnifying glass, then switches to smaller glasses to fill in details.

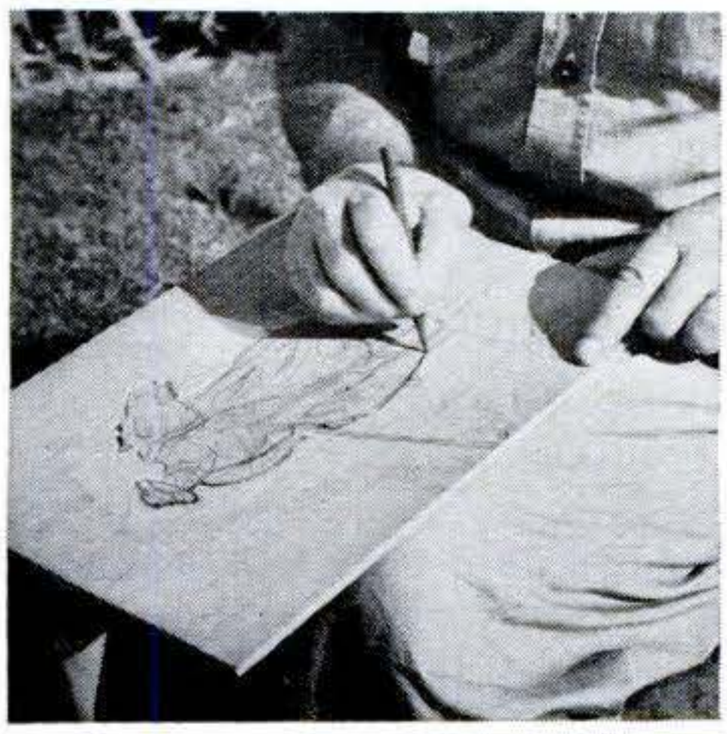
The Sun Carves this Craftsman's Wood

He burns pictures into pine, maple, or plywood with magnifying glasses.

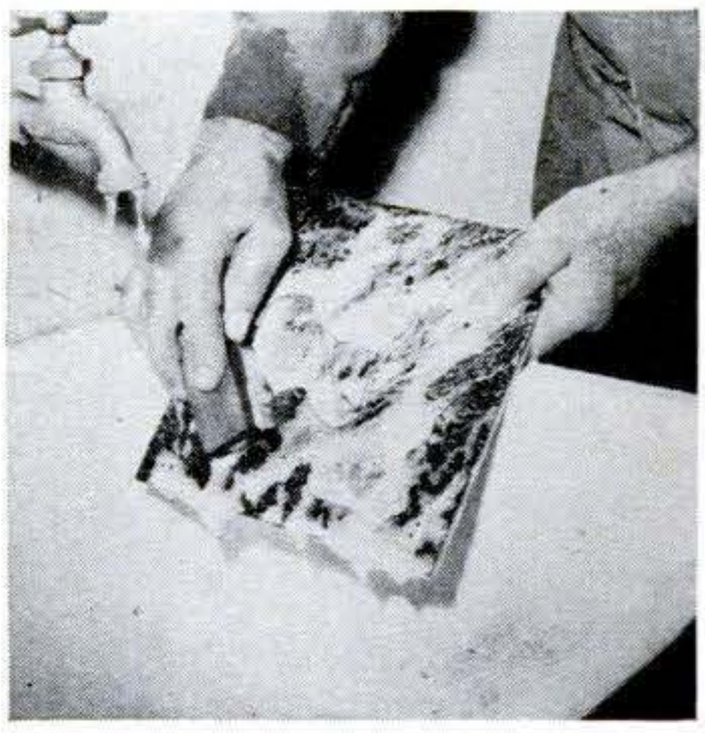
First step is carbon tracing of design. Wallingford uses easel for most operations.



After carving outline with a gouge, he black-pencils burn lines to absorb sun's rays.



Burning leaves smudges, so plaque is sanded, brushed, washed. Then it's lacquered.



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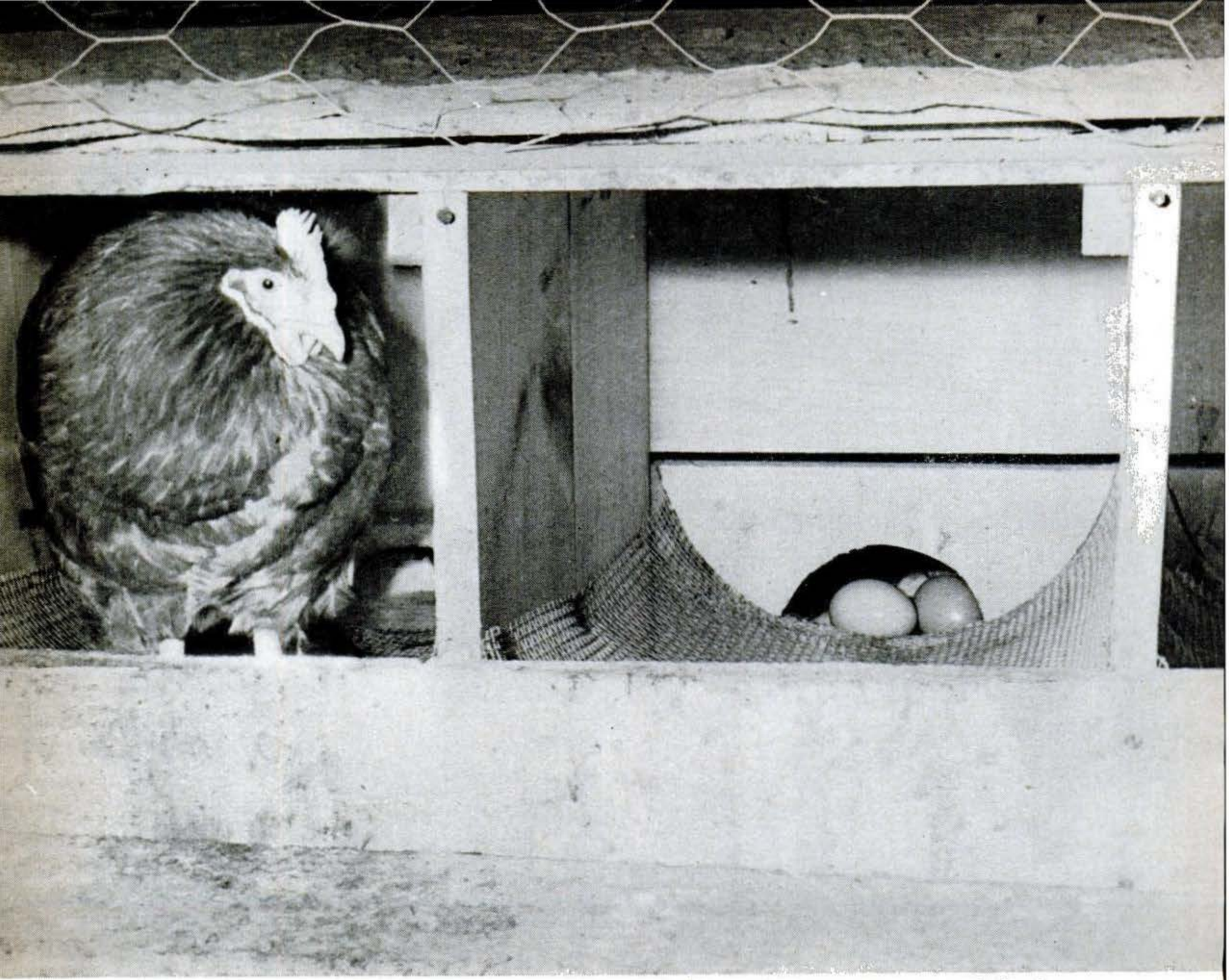

When hen lays an egg, it rolls down the nest's sloping floor of wire mesh, out through a hole in back, and onto a conveyor belt that runs between two rows of nests set back to back.

Farmer Builds Mechanized Egg Factory

By William Gilman

PHOTOS BY ELEANOR GILMAN

A NEW HAMPSHIRE chicken farmer's development of a machine that gathers eggs has completed the mechanization of the poultry business.

Now chickens not only eat from automatic feeders, drink from automatic fountains, and end up in automatic scalders and feather-picking machines (PS, May '49, p. 118). On Archie Coll's 9,000-hen egg factory at East Jaffrey, N. H., they even lay their eggs on a production line. No human hand touches the eggs until, sorted by weight, they are ready to be packed into crates for shipment.

A system of synchronized, motor-driven conveyors collects several hundred dozen eggs twice a day from the laying nests in Coll's big, three-story henhouse, carries them to a central packing room, and feeds them —at a rate as high as 3,600 an hour—into an automatic grading machine.

Only the grader is commercial equipment. All the rest Coll built himself. It took him 20 years of dreaming and tinkering while tending chickens the old-fashioned way. Today his perseverance and ingenuity are paying off by cutting his labor costs in half and practically eliminating losses from eggs dropped or cracked in handling.

The poultryman-inventor says he had

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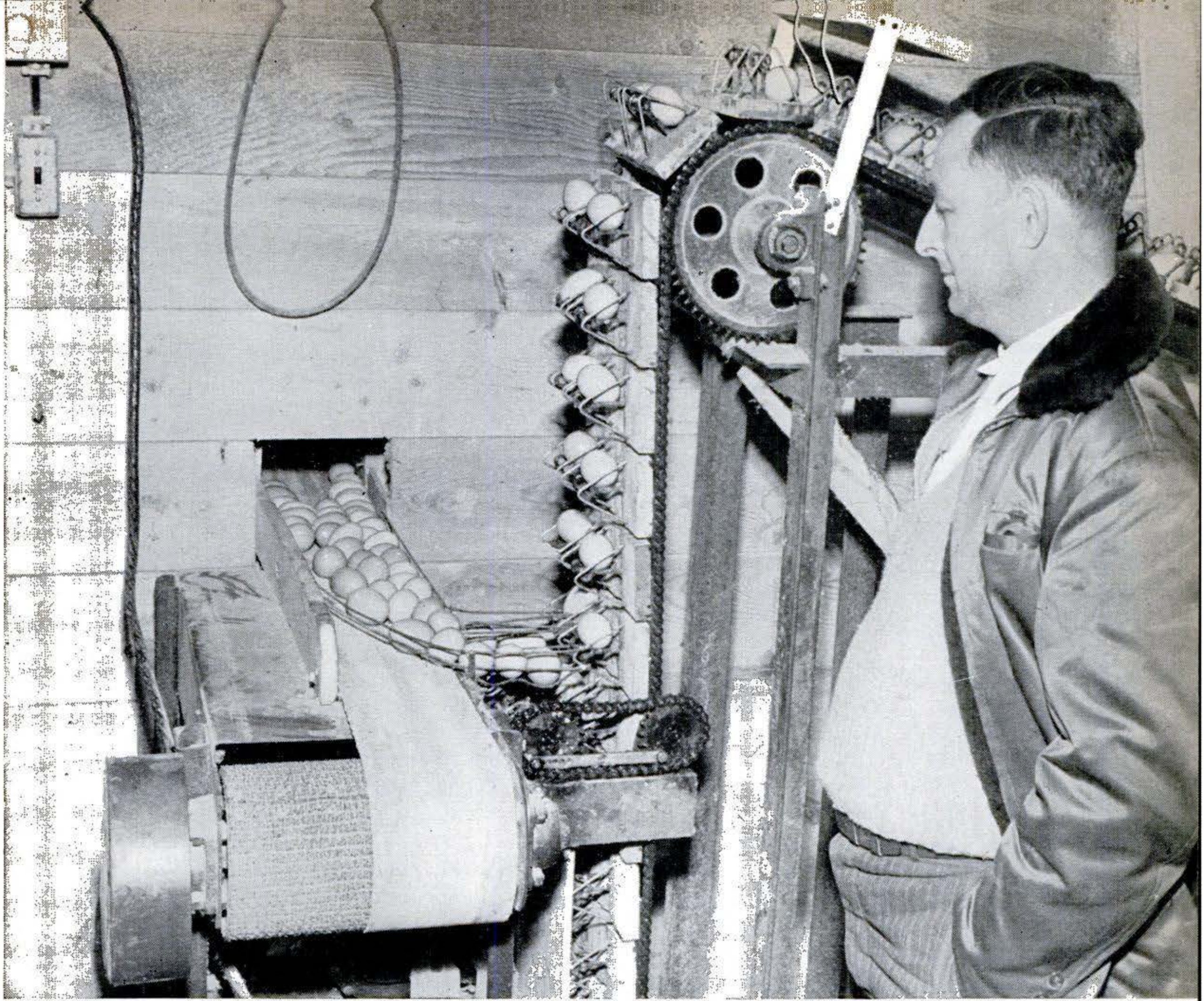

Collected from nests, eggs are shunted off the moving belt and picked up by wire fingers of a faster conveyor that carries them to the grading room. Looking on is the inventor.

three main problems to solve: The equipment had to go easy on the eggs, yet hold them firmly. Proper gearing had to synchronize the pace of its three elements—belt conveyor, chain conveyor, and grader. And—most troublesome of all, though it looked easy at first—Coll had to design a self-dumping nest that would please the hens and fool them into laying while still providing a means of getting the eggs out.

Here the difficulty was that biddy demanded soft shavings or some other kind of bedding litter to put her in the mood. But Coll had to have the egg roll out onto a conveyor belt, and the roughness of such bedding would prevent it from rolling freely enough to carry it out.

He tried all kinds of tricks and finally came up with a simple one that worked. His wooden nests have false floors of hardware cloth—wire mesh—rounded up on both sides to give the hen an illusion of nestling in something. A gentle slope sends the egg rolling out through a rear exit hole in the nest and onto the belt.

Two rows of nests, back to back, extend 170 feet down the center of each floor of the henhouse. Between them is a rubber-coated belt conveyor, six inches wide, on which the eggs collect. When it's time to gather them, a quarter-horse electric motor moves the belt and carries them into that floor's grain room at the end of the building.

Coll had to work backward in figuring out the timing of the conveyor to keep an even supply of eggs entering the grader, which takes one a second. The gathering belt moves them six feet a minute and feeds them into a vertical conveyor, serving all three floors, that runs 11 feet a minute.

Inventor Coll made this conveyor from roller timer chain, slightly larger than bicycle chain, to which are attached 4-by-10-inch plates of 1-inch board. On each plate

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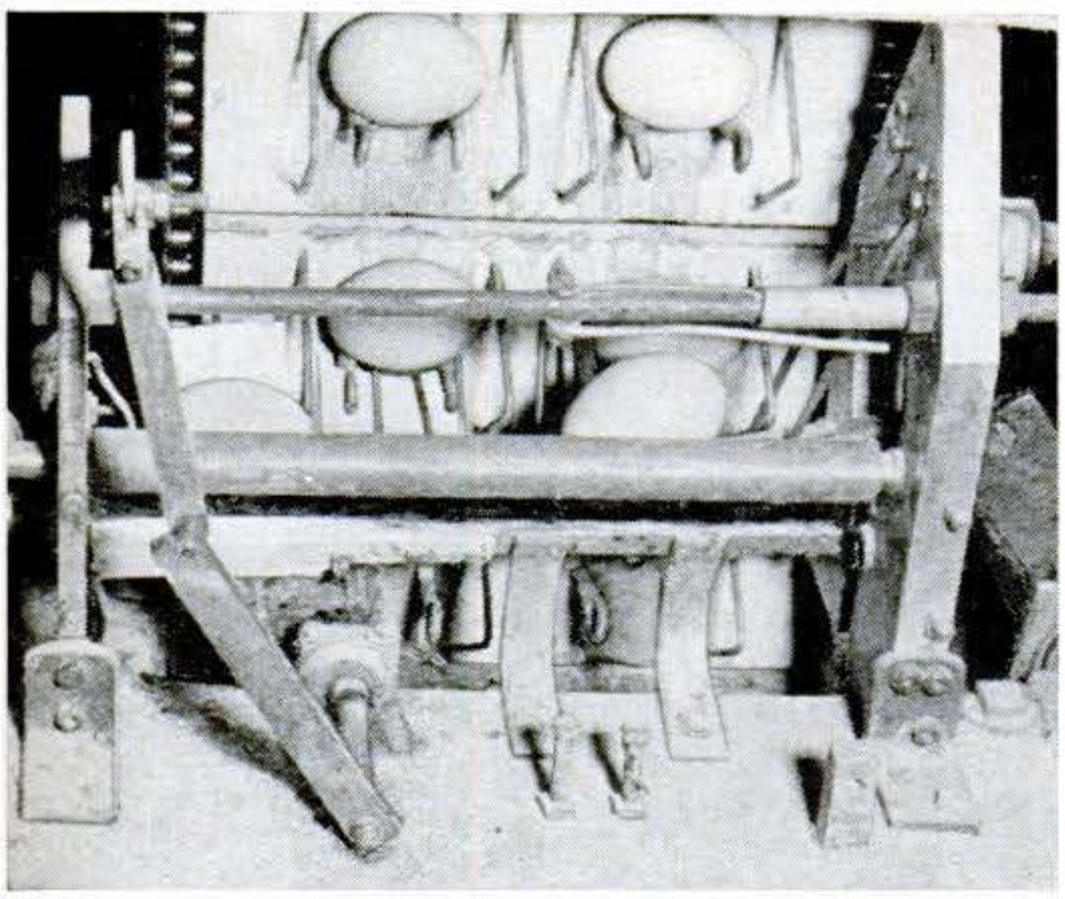
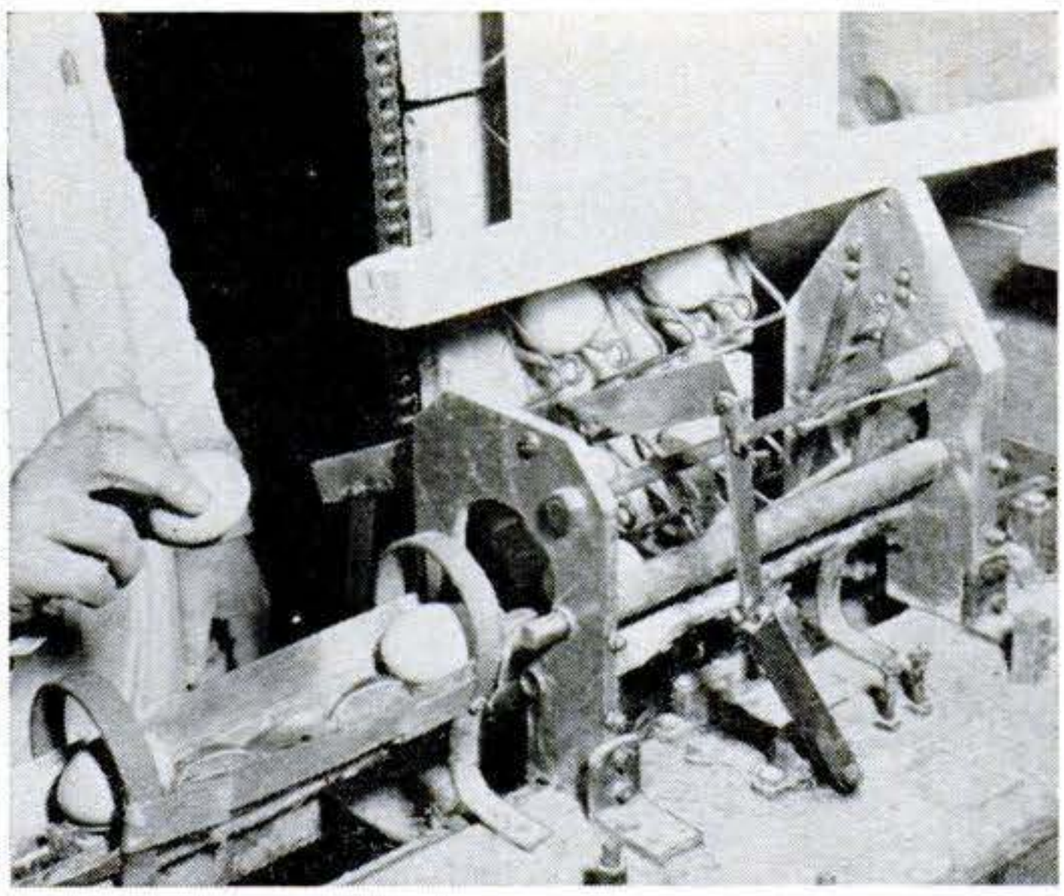


Near end of their ride the eggs roll off the conveyor's wire fingers and tumble end-over-end down a pair of rods that form a ramp, slanting toward the left, to the grader.



Cups made from tablespoons catch the eggs as they roll off ramp. Cups are attached to a bar that comes up between two rods, thrusts forward, then drops back for another stroke.

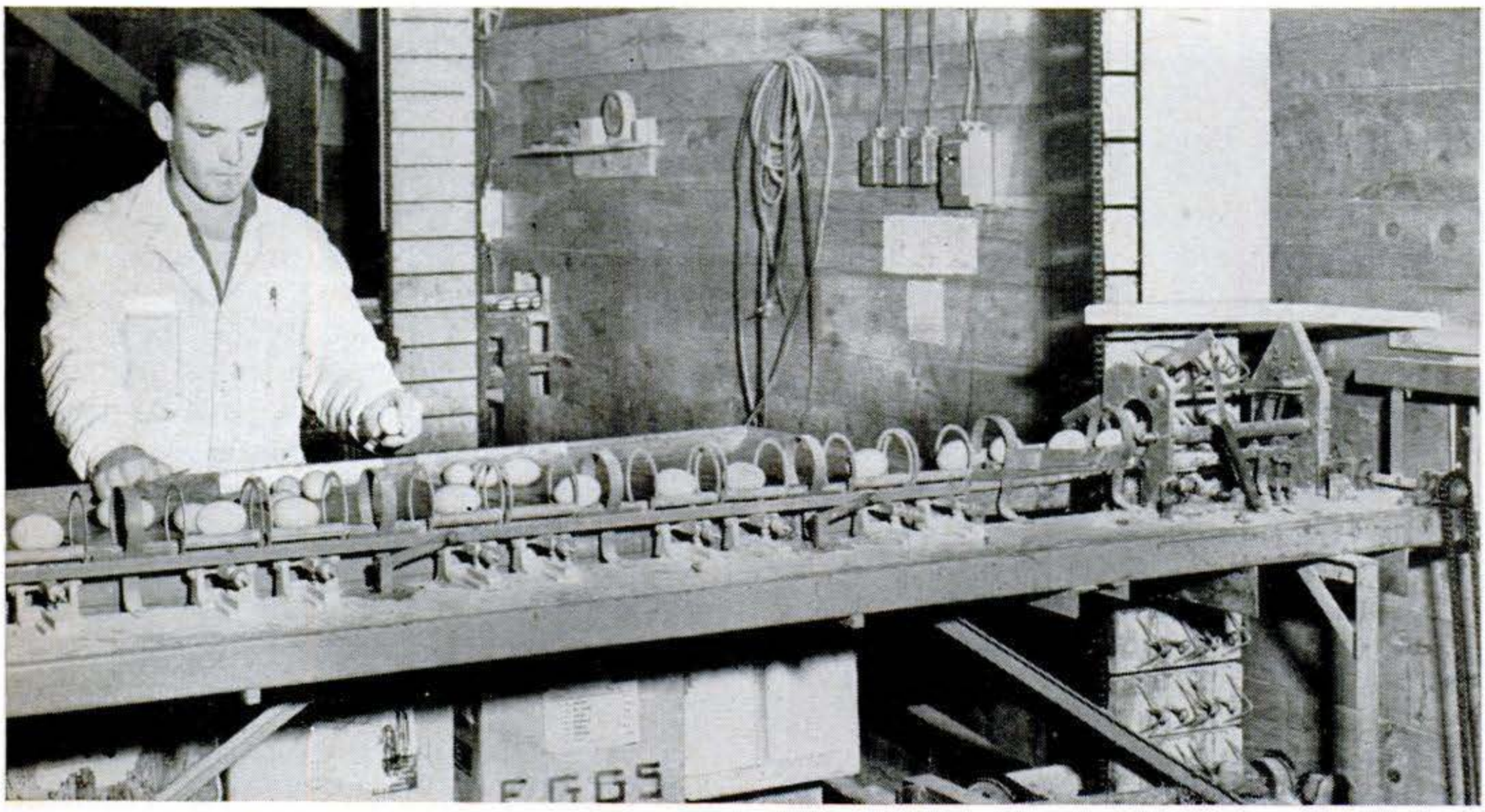
are mounted two pairs of bent-wire fingers. Actually they work more like cupped palms, each pair holding an egg.

These carry eggs from all three floors up to the third floor, then down to the grader on the second floor. This could be on any floor; Coll uses the second because his henhouse is built on a hillside, with a ground-level delivery entrance there.

The same ¼-hp. motor that runs the chain conveyor has a power take-off that operates the automatic grader. As eggs come off the conveyor, they pass a straightening bar and then ride into the grader on a row of tablespoons that Coll "borrowed" from his wife. As a result, the eggs enter the grader evenly spaced and facing straight ahead, so they'll come to rest properly on a series of tiny platforms that weigh them and then tip them off sideways into appropriate sorting trays.

The grader, though store-bought, had to be fed by hand until Coll devised the spoon arrangement. Now the only man needed to run the whole thing is the one who picks the eggs out of the sorting trays and places them in the shipping crates.

The rest is done by electricity. END



In the grader the eggs, evenly spaced by the row of cups, move over a series of automatic weighing stations. These are graded from heavy to light. Each egg moves along until it reaches the station where it overbalances the counterweight, then it is tipped out into a sorting tray.

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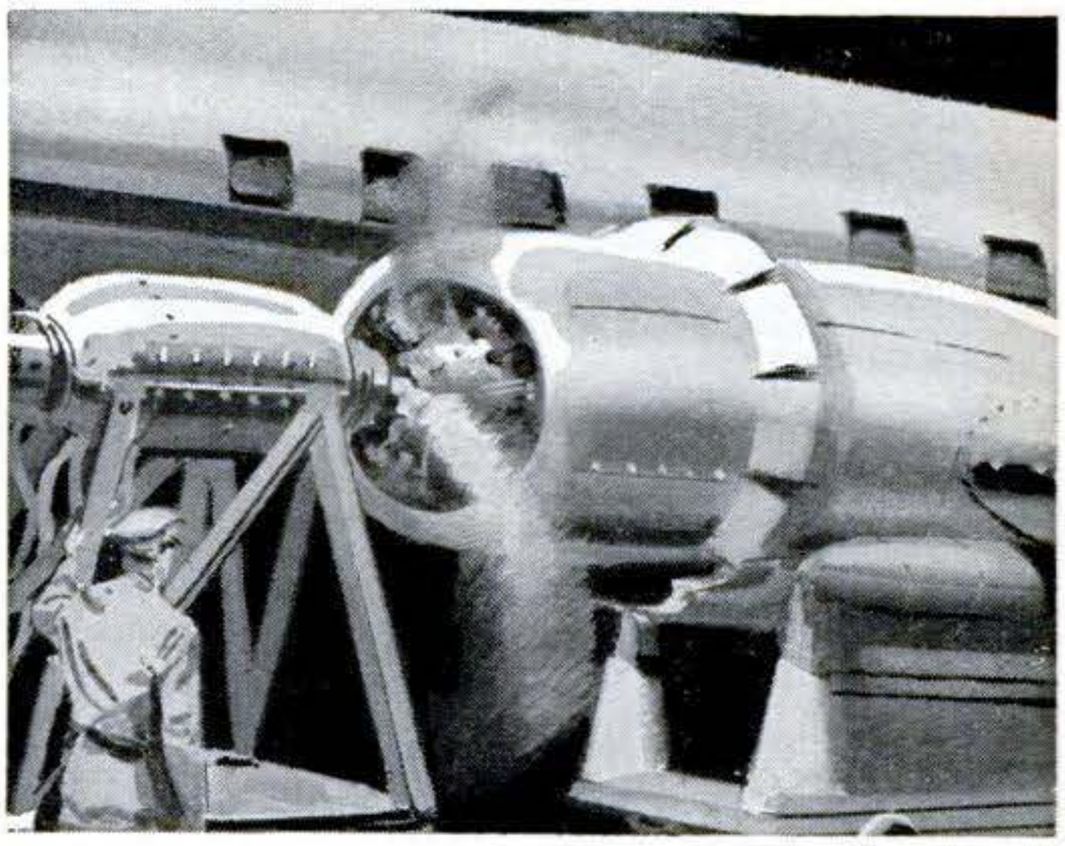
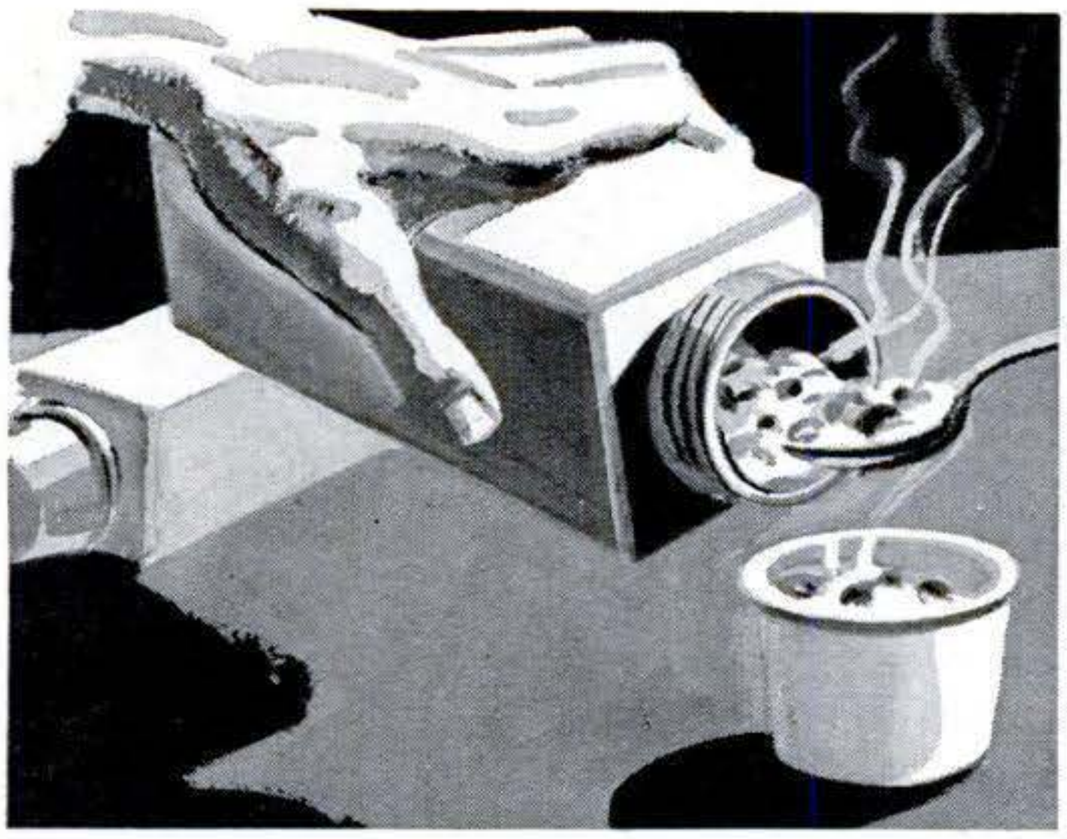
I'd like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



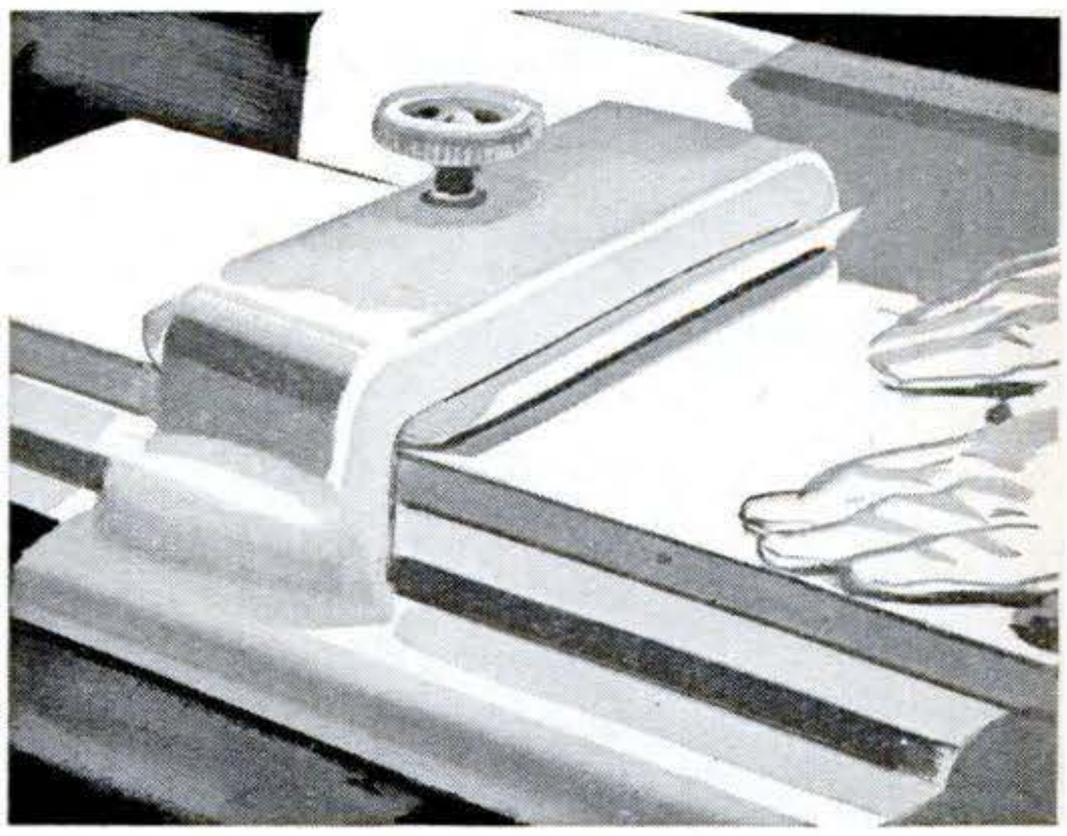
"Warm-up" stands for planes that would hook in a dynamometer to take propeller load and cut out prop noise; and a muffler chamber to absorb exhaust noise. Would quiet areas near airports.—*G. P. Cameron, Inwood, N. Y.*



A vacuum bottle with a square case and a wide mouth. A square bottle wouldn't roll off flat surfaces, and the wide mouth would allow it to be used for carrying either liquids or solids.—*Albert Windsor, Lakeside, Ore.*

Rubber molding on the outer edge of car doors. This would prevent scratching or marring neighboring cars parked closely alongside you when you accidentally open your doors too far.—*E. R. Whitney, Pittsfield, N. H.*

Plastic eyeglass frames that could easily be taken apart so that the lenses could be slipped in and out quickly. One set of lenses would serve for several frames of different colors.—*N. Shalit, Morristown, N. J.*



An attachment that would clamp to a conventional jointer to convert it to a thickness planer. Perhaps it could be a bridgelike structure with an adjustable shoe and a pressure platen.—*F. Brundick, Baltimore, Md.*

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Big Guided Bomb Now in Use

LARGEST of its type, this six-ton Tarzon guided bomb has been blasting Korean bridges and other pin-point targets since last August, the Air Force reveals. After it has been dropped, the bombardier can steer it by radio control of its rudders, turning misses into hits. A flare mechanism lets him track it with a special bombsight.

Documents Copied without Darkroom

WITHIN 60 seconds, the desk-top device above will turn out a dry finished 3¼-by-4¼-inch copy of a letter, drawing, or photograph. It also takes close-ups of machine parts. Made by Polaroid Corp., Cambridge, Mass., it uses a standard Polaroid Land camera and a copying lamp. Light-polarizing filters eliminate shine from glossy paper.

New TV Tube Made From Talc

INSTEAD of a glass casing, the 1,000-watt TV transmitting tube above uses a ceramic made primarily from magnesium silicate—the same stuff as the talc in talcum powder. This will boost efficiency, its General Electric designers say, in the ultra-high-frequency channels scheduled for TV use by the Federal Communications Commission.

Power Car at Each End Propels Two-Way Train for Egypt

AS ADAPTABLE as a ferryboat, this British-built train for the Egyptian State Railways runs equally well in either direction. A Diesel-electric power car at each end drives the articulated five-coach express and will propel it at 75 m.p.h. on the Cairo-Alexandria run. Nine of the new trains are on order.

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How to Add a Car Port to Your Home

These open shelters for your car cost less than a garage—and they can be planned for easy conversion later on.

By Carl T. Sigman and William J. Ward, Jr.

A CAR PORT isn't just a makeshift garage. Economy may be a factor, but in many cases an open-side shelter fits in better with the design of a house, and adds to its appearance. Although obviously not a safeguard against extreme cold, a well-planned port will protect your car from the damaging effects of sun, rain, and snow.

Nor is a car port merely a compromise. It has advantages that make it the choice over conventional garages in many fine homes, particularly where the weather is mild. First of all, it obviously costs less than a garage, having neither walls nor doors. It may take advantage of one house wall or an "L" in the building for shelter from the worst weather

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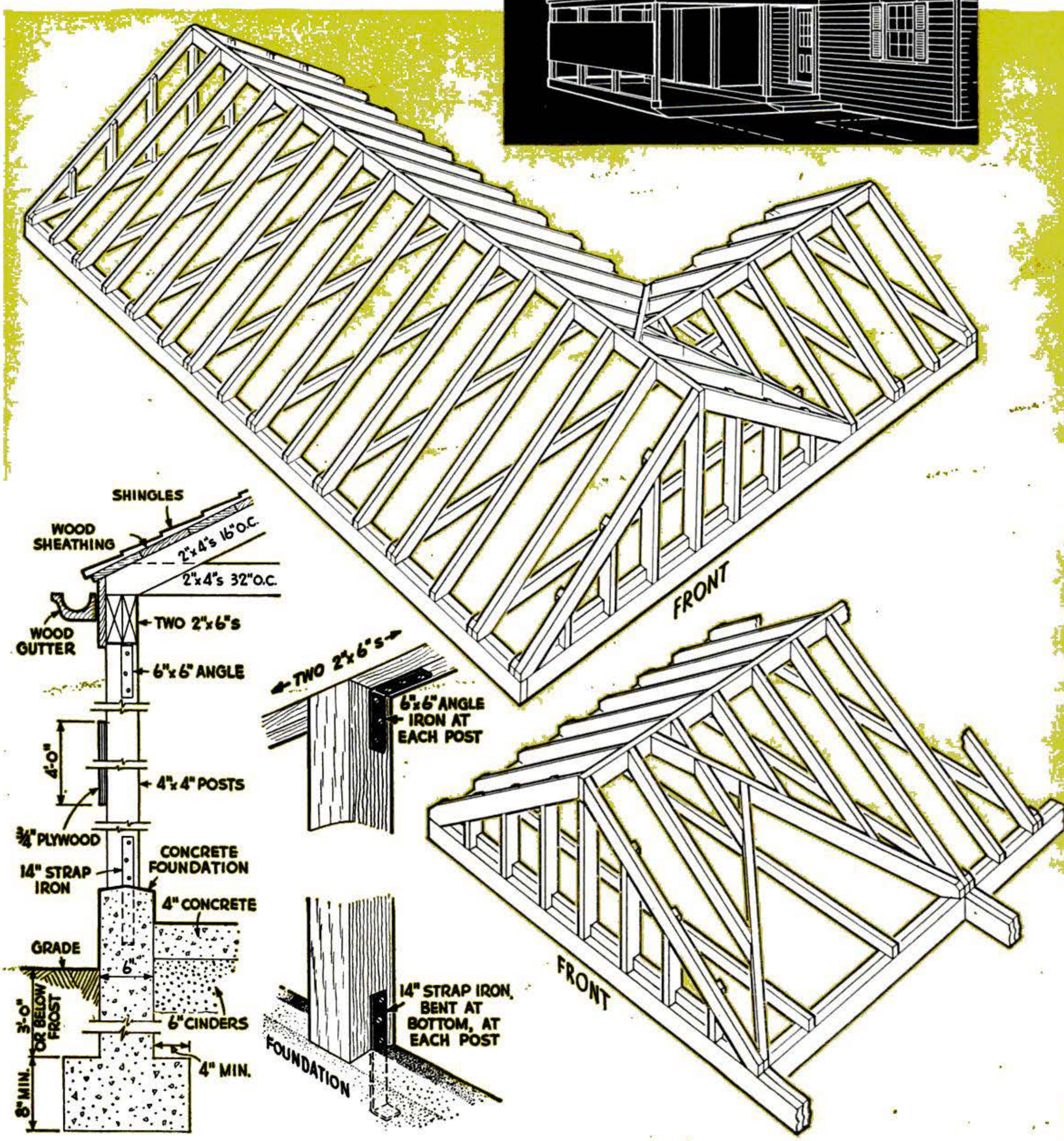
quarter. If space permits, it can be the drive-through type, doing away with backing down a driveway and into a busy street, an advantage women drivers especially appreciate. Also, the house may have a door or window that a built-in garage would shut off, but a car port would leave accessible. And, finally, a car port can be planned for future conversion into a garage.

The two shelters shown here are designed to conform to common building-code standards. But check the plans against your local codes, and find out whether a permit is required, before you start actual construction.

Both these car ports are 10′ wide and 20′ long; any increase in these dimensions may call for structural changes as well. On the other hand, making them smaller will save you little and cramp their utility. If a car doesn't require the full length, consider adding storage closets as shown in the second design. They'll go equally well in the first,



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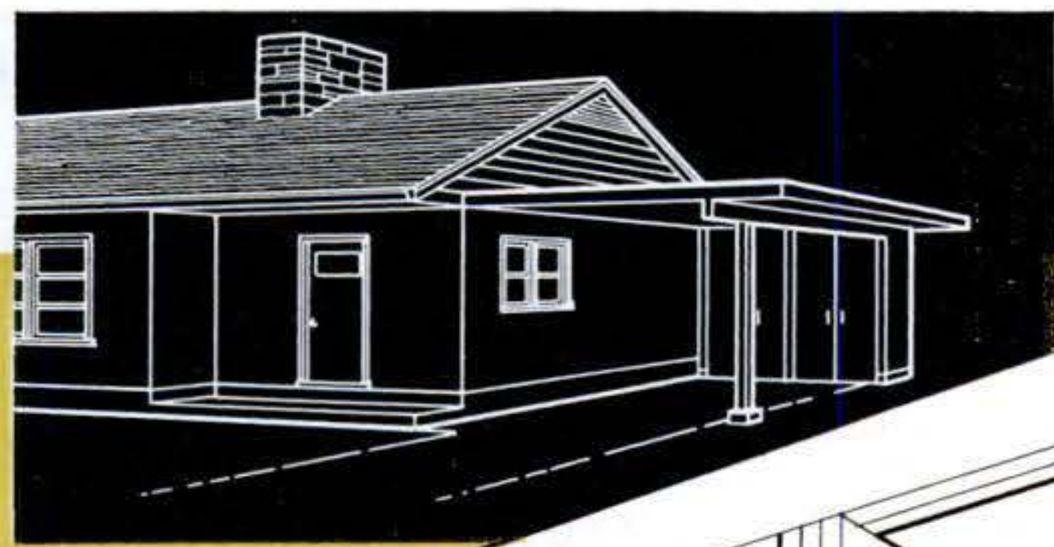
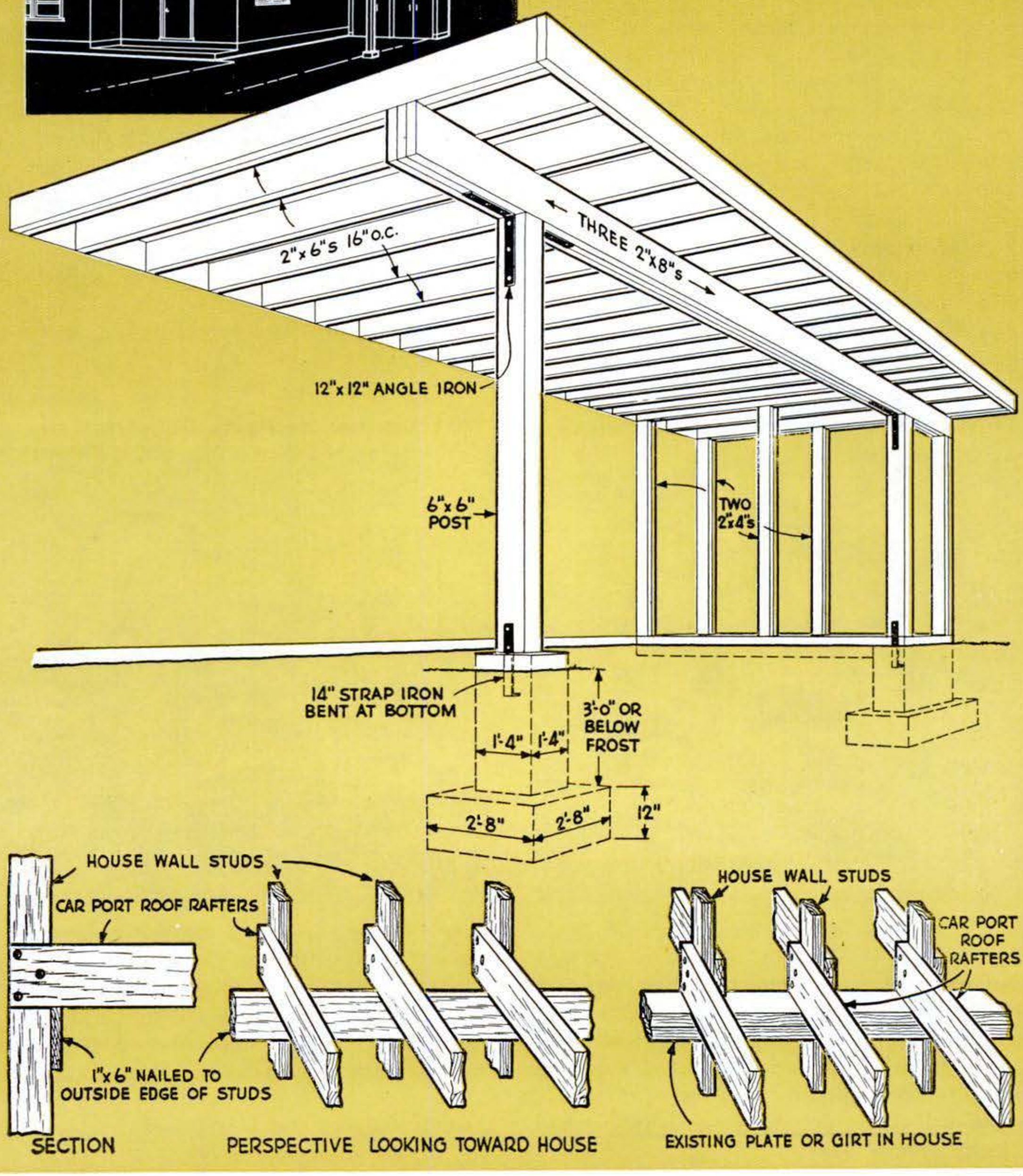
providing space for bicycles, toys, lawn mowers and other garden tools, storm windows, and so forth.

Breezeway style. The first design is best adapted to a traditional or conservative house. It affords a sheltered passage from the house to the car, but leaves the door accessible from outside as well, even if you convert to a garage later on.

Don't skimp on the concrete footing. Run it completely around the structure. Pour the footing on undisturbed soil. The foundation may be of poured concrete or concrete blocks.

Steel straps running into the foundation, and angles at the top of the posts, anchor the roof down against wind uplift. These metal parts can be recessed and painted like the wood to make them inconspicuous. The partial wall, of ¾" outdoor plywood, affords lateral bracing, plus additional privacy and weather protection. Without it, a strong





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wind could "corner" the structure out of plumb.

The roof pitch of breezeway and car shelter should be the same as that of the house roof. Horizontal two-by-fours are placed 32″ on centers as collar beams to counteract spreading of the roof. The end beams are notched into the two-by-four gable studs. Both rafters at the house end of the breezeway should be securely nailed to framing members of the house, for which the wall siding and sheathing will have to be removed. The two plates, made of doubled two-by-sixes, should also be secured to the house framing. The best way is to extend the plates onto one of the house plates, as detailed in the drawing for the flat-roof type.

Copper, aluminum, or galvanized flashing should be laid up against the house sheathing and out over the roof sheathing. Asphalt roll roofing will do if metal isn't available. The roof and the gable ends should be covered to match similar areas on the house.

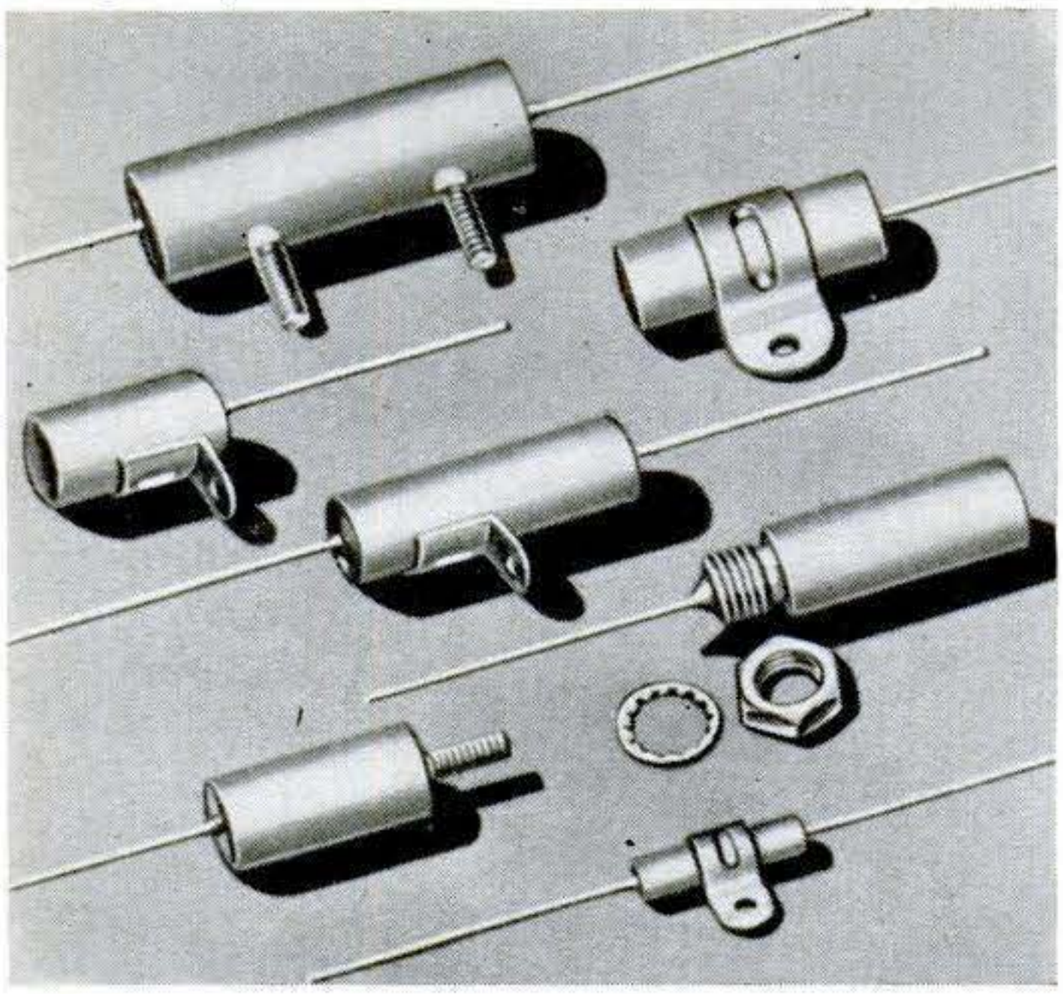
Flat-roof shelter. This is best suited to a ranch-style house or one of the similar more modern designs. Though substantially flat, the roof should have a slope (away from the house) of at least ½″ to the foot. Individual concrete footings will serve, and the gravel or other driveway surface can simply be extended under the area. The six-by-six posts carry a girder built up of three two-by-eights. This supports two-by-six rafters spaced 16″ apart at their centers.

If the house wall has a plate at a suitable height, nail the rafters of the car-port roof to this as shown in the detail at the extreme right of the drawing. If there is no plate, nail a one-by-six to the studs and carry the rafters across this, nailing them to the faces of the studs. Flashing must be laid against the house sheathing and over the shelter roof at least 8″ each way.

A professional roofing job with copper or canvas will last for years. Somewhat cheaper is a roof you can lay with "cold-application" felt. This usually calls for a layer of rag felt, nailed right to the sheathing, followed by two layers of asbestos felt, cemented down. Follow the manufacturer's directions closely in applying such roofing.

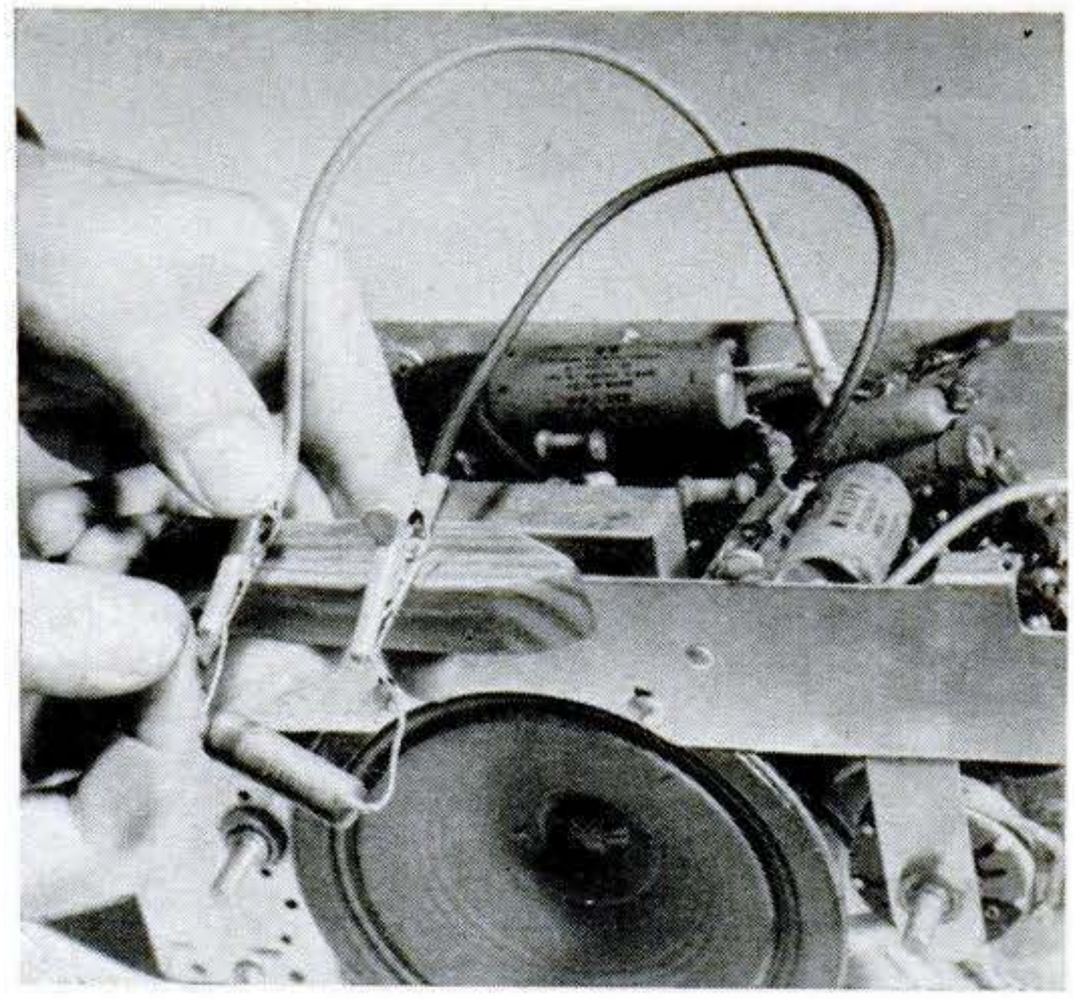
The storage space at the rear can be enclosed with ¾″ outdoor plywood, nailed directly to the doubled two-by-fours. Since the house wall provides lateral bracing, no sidewall is specified. END

Tiny Capacitor Mounts Resist Shock



THESE metal-cased miniature paper capacitors can be mounted rigidly in any position on an electronic chassis. They are available with threaded necks, side or end studs, or horizontal or vertical brackets. Designed to overcome shock and vibration problems in military gear, they are now being offered as standard items by Sprague Electric Co., North Adams, Mass.

Test Jig Speeds Parts Substitution



IF YOU repair radios by the old-reliable method of substituting a good part for one you think may be bad, you'll find this test jig a big help. To make the jig, solder alligator clips to both ends of two pieces of wire. Screw one pair of clips to a small block of wood. You can clip the leads to any part of the set and slip substitute parts in and out of the jig in a jiffy.

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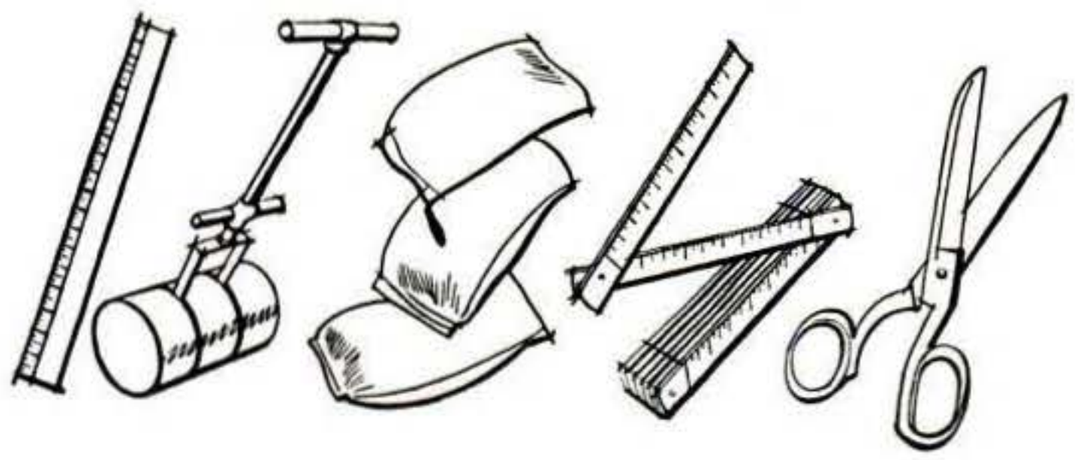
Laying Linoleum



from A to Z You can cut the cost a lot by doing the work yourself. And it isn't as hard to do a good job as many people think.

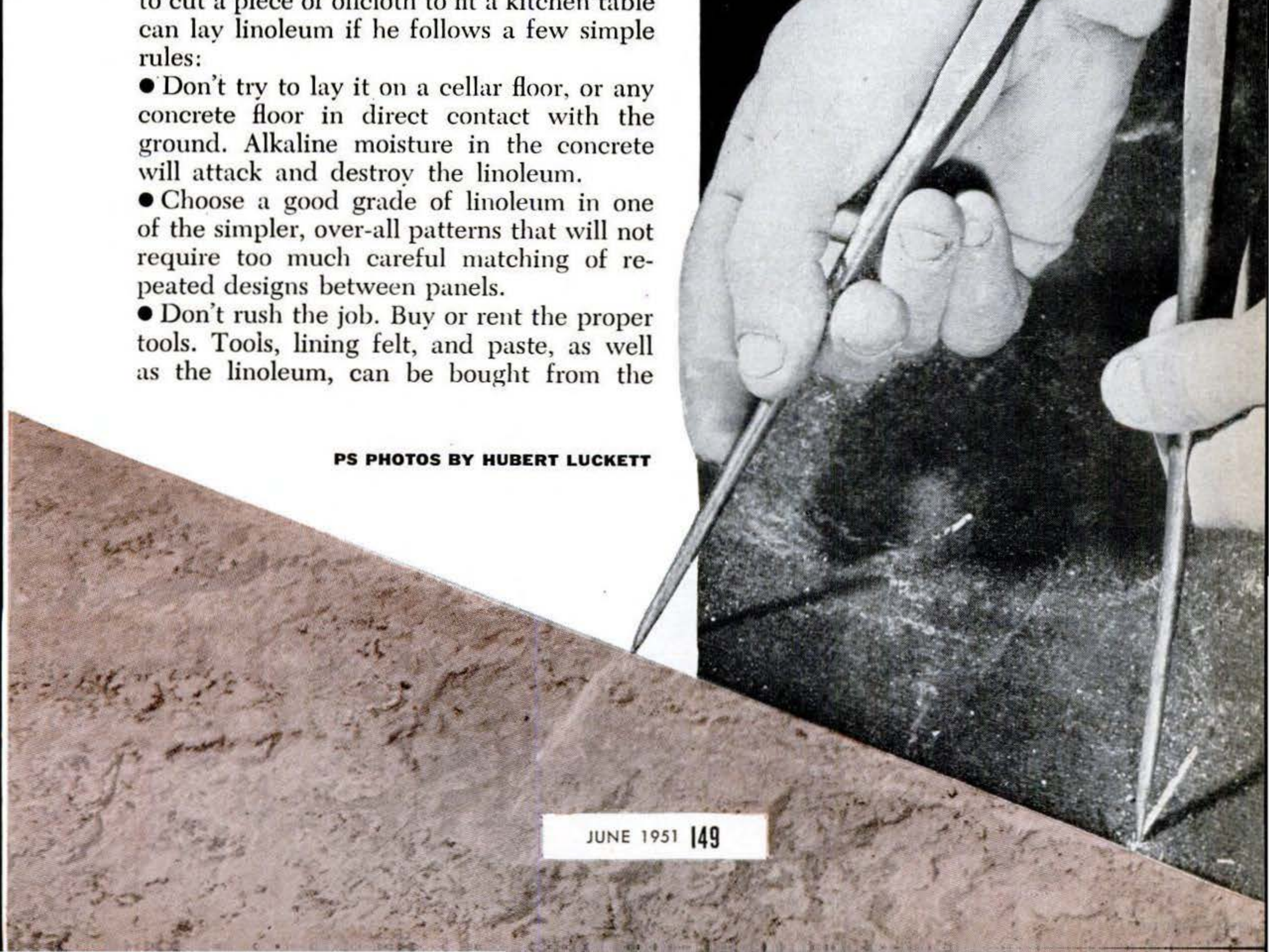
By George H. Waltz, Jr.

IF YOU plan to lay a linoleum floor, this is the time of the year to do it. Linoleum is less brittle and much easier to work when the room temperature is above 70°.

Experts may tell you that laying linoleum is no job for an amateur. But don't let them scare you. Anyone with enough know-how to cut a piece of oilcloth to fit a kitchen table can lay linoleum if he follows a few simple rules:

- Don't try to lay it on a cellar floor, or any concrete floor in direct contact with the ground. Alkaline moisture in the concrete will attack and destroy the linoleum.
- Choose a good grade of linoleum in one of the simpler, over-all patterns that will not require too much careful matching of repeated designs between panels.
- Don't rush the job. Buy or rent the proper tools. Tools, lining felt, and paste, as well as the linoleum, can be bought from the

PS PHOTOS BY HUBERT LUCKETT



larger mail-order houses. When figuring out how much prepared linoleum paste you'll need for your own particular job, allow about 1 gal. for every 100 sq. ft. of floor surface. The paste is available in quarts and in 1, 3½, and 5-gal. cans.

● Prepare the floor carefully by removing any old finish, smoothing rough spots, nailing down loose boards, and countersinking any nails that project. Linoleum paste will not form a lasting bond with any surface that is coated with varnish, wax, shellac or paint, and the linoleum itself will not be any smoother than the floor surface over which you lay it.

The felt underlining should not be put down until the floor is well prepared. The felt makes a bond between the linoleum and the floor, provides enough give to prevent floorboard shrinkage from wrinkling or damaging the linoleum, and produces a quieter, warmer, more resilient surface.

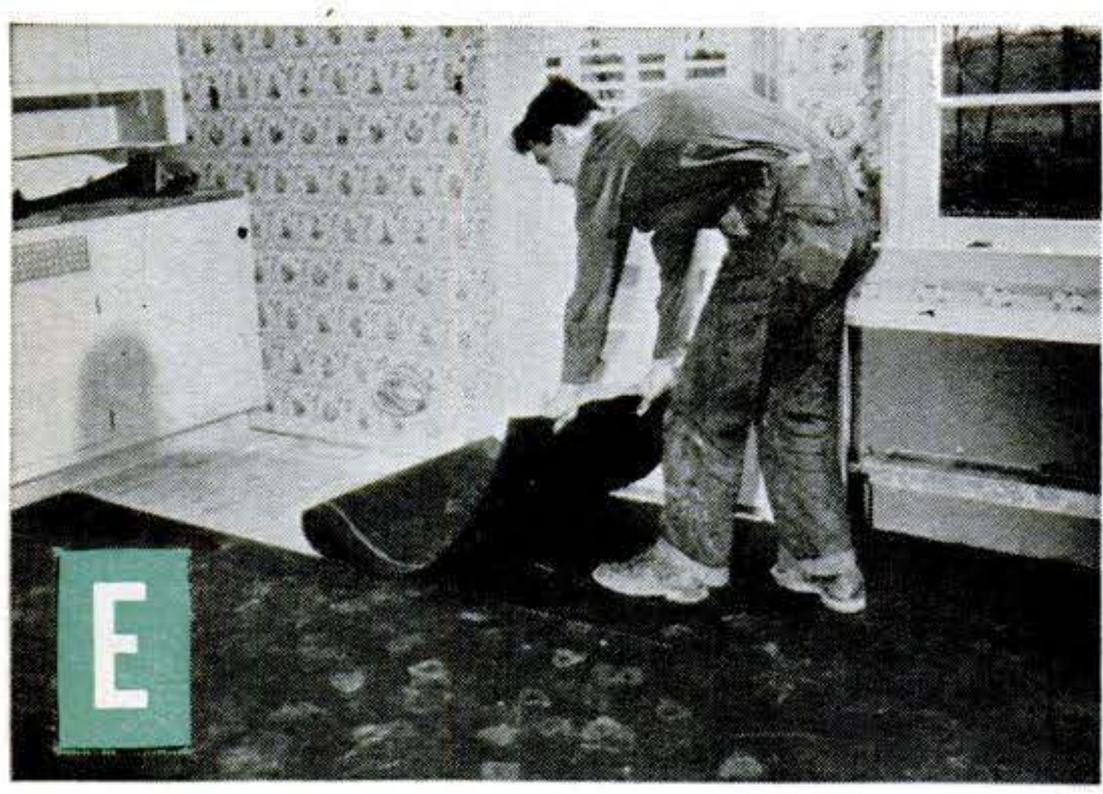
Cut the strips of lining felt to fit the floor accurately with shears or a linoleum knife, and lay them across the floorboards with the edges forming butt joints. Overlapping is liable to show up as a ridge in the finished floor.

The basic principles illustrated by these photographs, showing the laying of a floor that has alternating diagonal strips of contrasting colors, also apply to the installation of a simple pattern that runs straight across from wall to wall.

The only fitting problems in the latter type of installation occur at side walls where

To prepare the floor, begin by removing the quarter-round molding strips around the baseboard, being careful not to split them since they will be replaced. A small chisel is a good tool for prying them loose.

Remove any finish, such as varnish, paint, shellac, or wax from the floor. Any unevenness in the floorboards should be sanded smooth. An over-flooring of plywood should be added when a floor is in extremely bad shape.



After the felt strips have been carefully cut and have been laid down on the floor with their seams butting, fold each strip back on itself for about half its length to expose the floor. Sweep the floor clean.

Apply linoleum paste to the surface of the floor with a notched trowel or spreader. Spread on a thin, even coat and don't cover more than 36 sq. ft. at a time because the paste dries in about 10 minutes.

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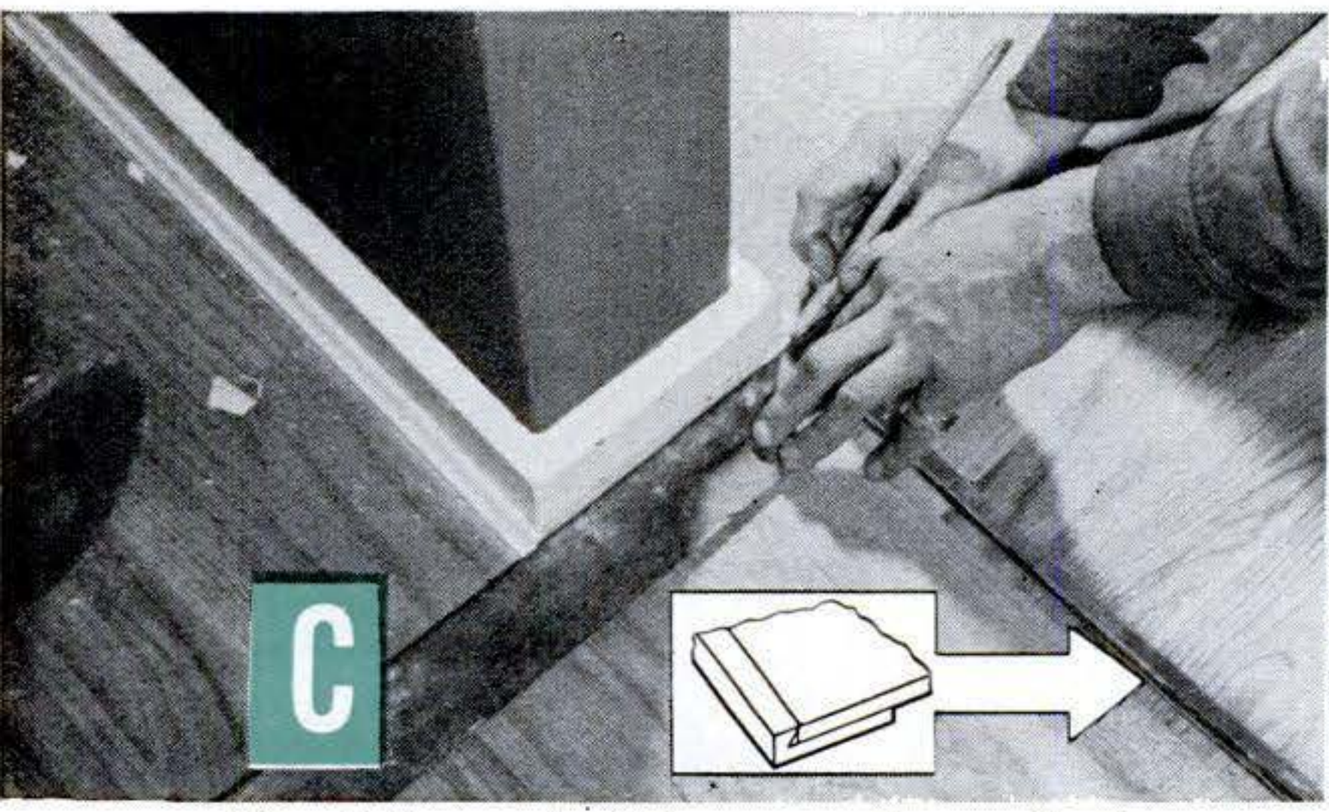
the first and last strips must be cut along their length to allow for irregularities in the wall and projections. Guide lines for these cuts can be marked with a pair of dividers. Set the dividers slightly wider than the depth of the largest projection. Then, with the linoleum butted against the wall, move the dividers along the wall at right angles to it. One leg will follow the wall's irregularities and the other will duplicate them on the linoleum. The ends of the linoleum strips (which should be cut longer than the length of the room) can be trimmed down a bit at a time with a linoleum knife until they butt snugly against the end walls.

The same systems for cutting butt joints shown in connection with the laying of a diagonal pattern can be used in the laying of a pattern that runs straight across from wall to wall.

Ironing the butted seams, rolling the entire floor, and sandbagging the seams to hold them down for at least 12 hours are important.

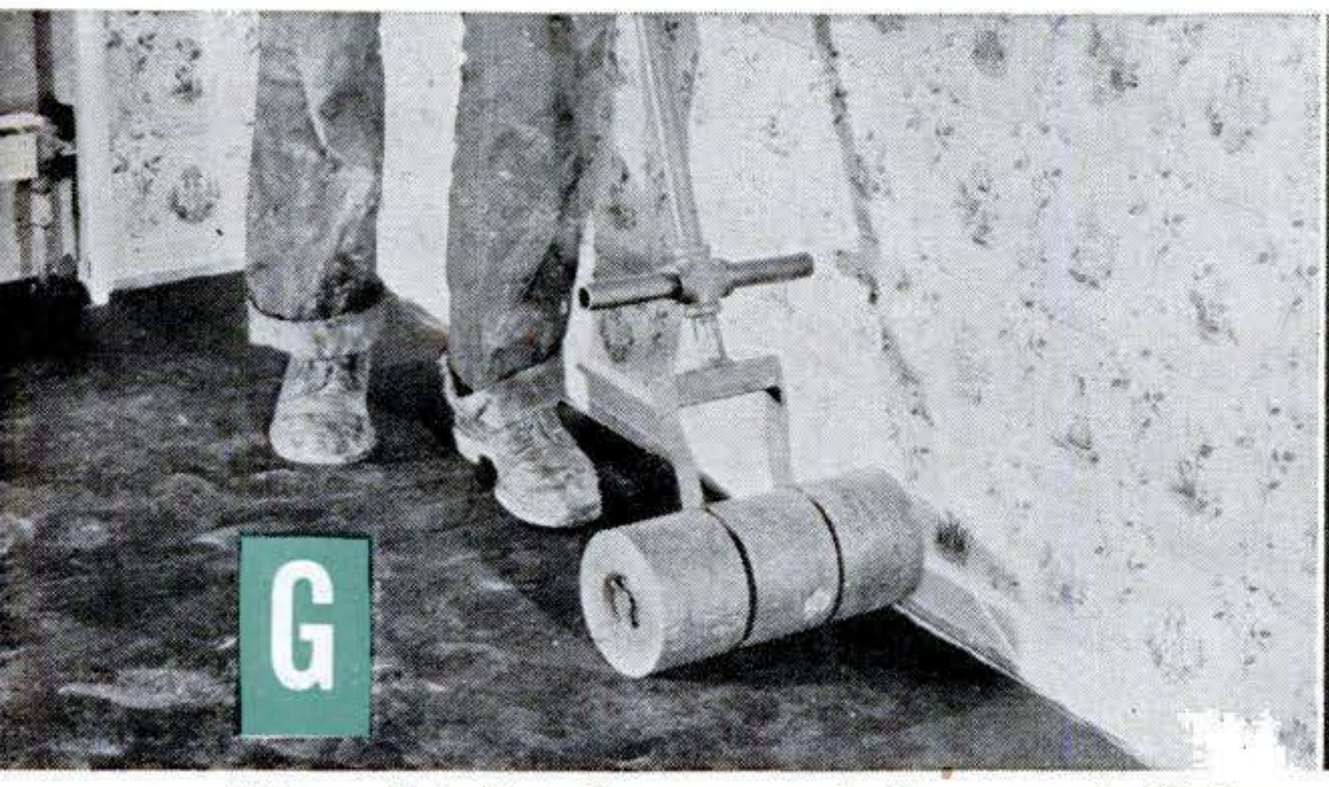
If you cannot rent a linoleum roller from your neighborhood hardware store or linoleum dealer, clean a small lawn roller carefully and press it into service. Flour bags or heavy paper bags filled about three-quarters full with sand or dirt can be used for sandbags.

Plan the job carefully, take your time and, if some particular fitting and cutting problem stumps you, solve it with a piece of heavy wrapping paper before you dig your knife into the linoleum.

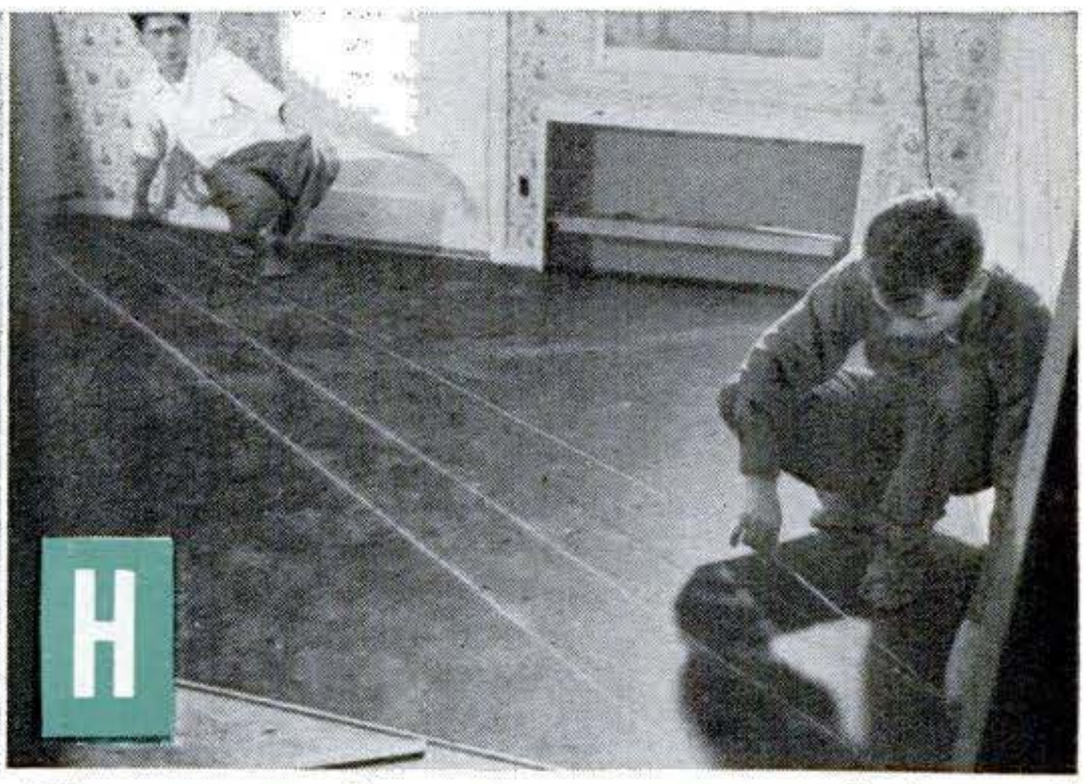


Beveled metal edging must be used wherever linoleum is to meet a bare floor. Here a piece of this nosing is being measured before being nailed into place. Edge of linoleum fits into lip.

The strips of lining felt, cut from a 36-in.-wide roll, should run across the floorboards. Felt should be cut with shears or linoleum knife to fit contours of baseboards.



When felt has been pasted down on half the floor, roll it. And when whole floor has been covered, roll the felt again. Sweep it clean. Then, if the linoleum is to be laid in any special pattern, mark the position of the first strip on the felt with chalk.



The pattern here was to consist of diagonal strips of contrasting colors. So a corner-to-corner chalk line was snapped in first, then more lines were snapped in on each side of the diagonal at distances equal to half the desired strip width plus 2 in. This extra width will allow trim for a butt joint. [*Continued on next page*]

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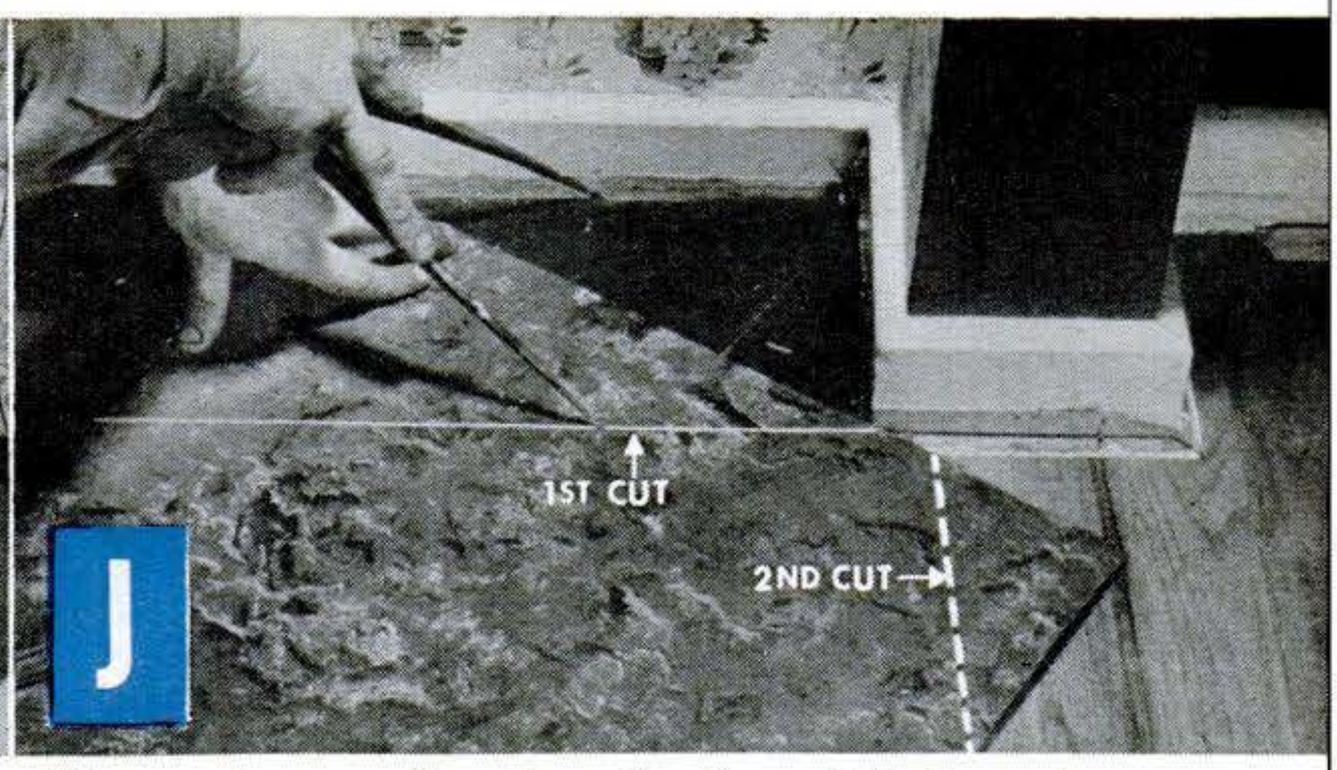
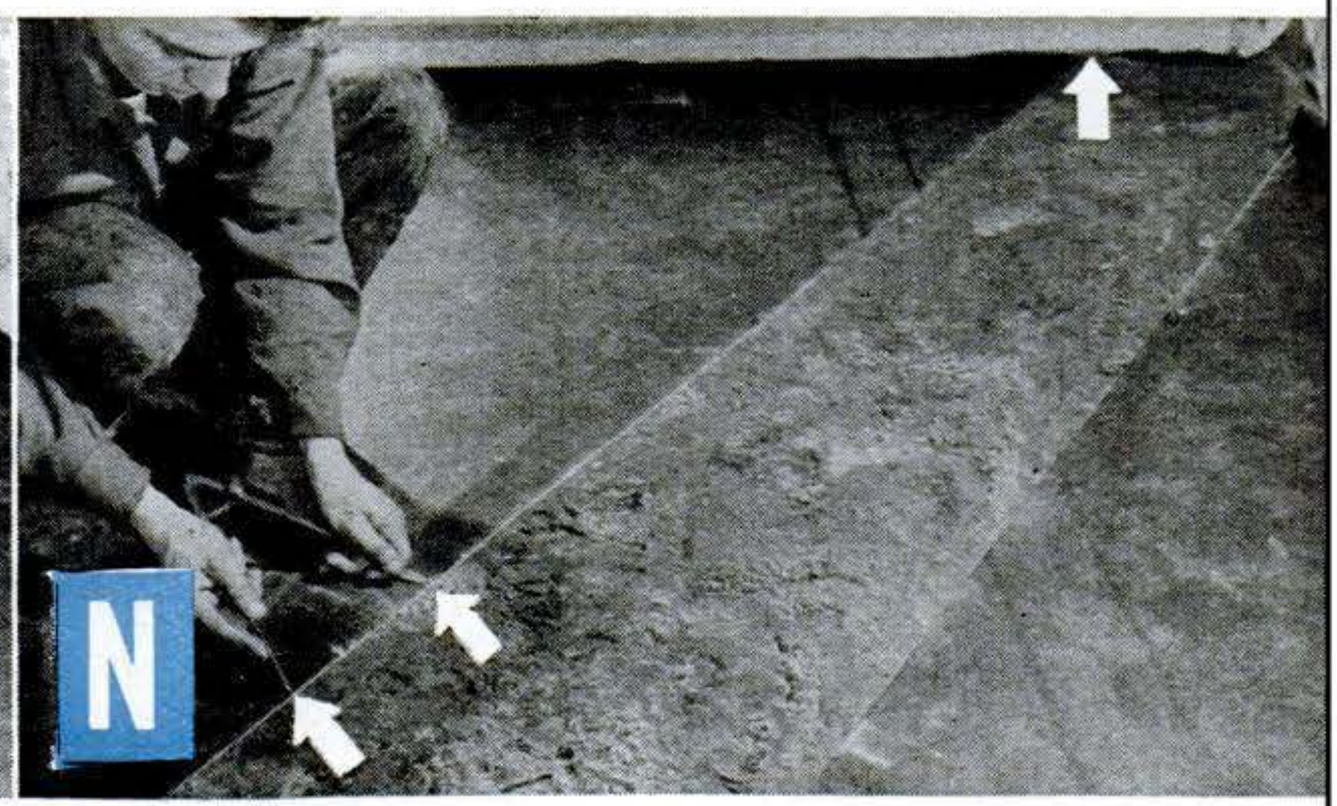
The first strip was cut 4 in. wider and 8 in. longer than necessary to fit. The excess width allowed for cutting butt joints between strips, the extra length for fitting and cutting at the end walls. This applied to all strips.



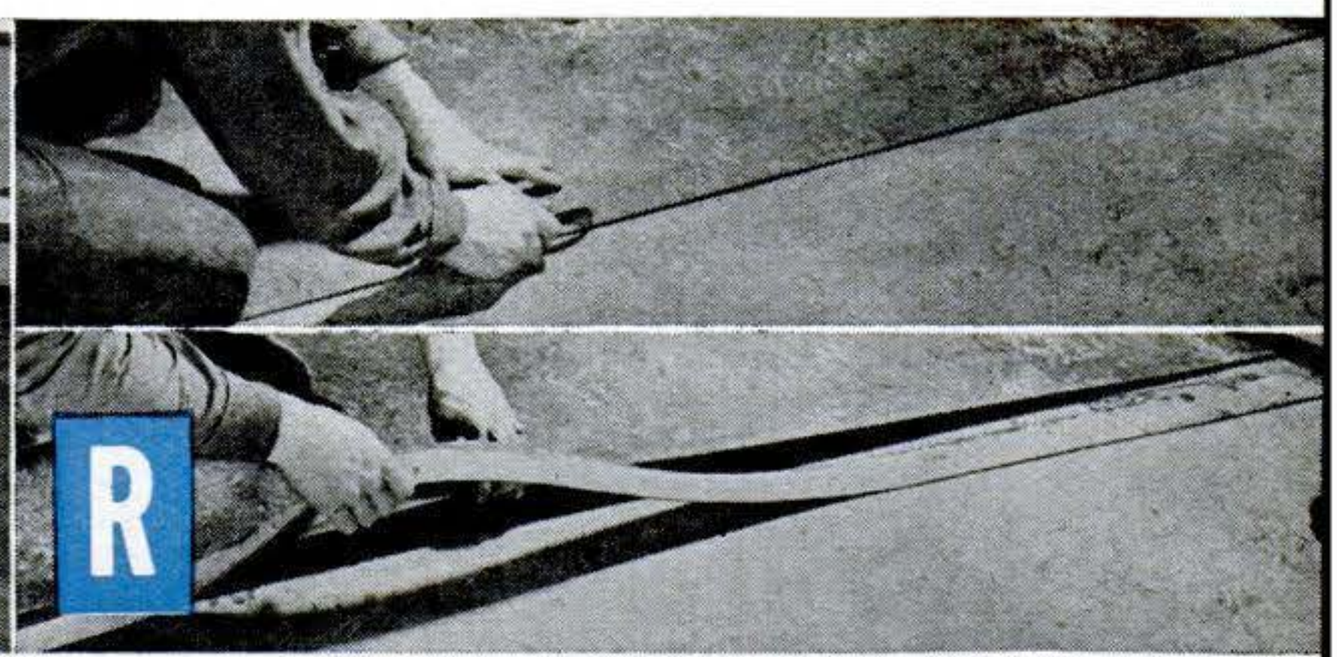
First strip was placed on the floor with its ends riding up walls, then pulled back until one corner just touched wall at one end. With a pair of dividers set to depth of projecting wall at right, a line was scribed on linoleum and a 1st cut made along this line. Excess also was cut off roughly (2nd cut) from other corner of strip.

To fit the other end of the first diagonal strip into the opposite corner of the room, the first step was to mark both the linoleum and the felt with a chalk line at about the middle of the room. This provided an important reference mark for the next step.



The strip was pulled back until a corner of the end just touched the wall. Then the dividers were set to equal the distance the chalk mark on the linoleum had been moved back from the mark on the felt (see arrows).

As in laying felt, the cut strip was rolled back on itself, paste was spread, and that half was put into place. Each strip was cut to fit the walls, then placed so as to overlap the edge of a previous strip to allow for a butt joint.



This is one way to cut a butt joint. The edge of the strip to be placed is used as a straightedge to guide the knife in cutting excess from strip already in place (upper photo). Excess then can be lifted out and new strip plopped into place in the paste.

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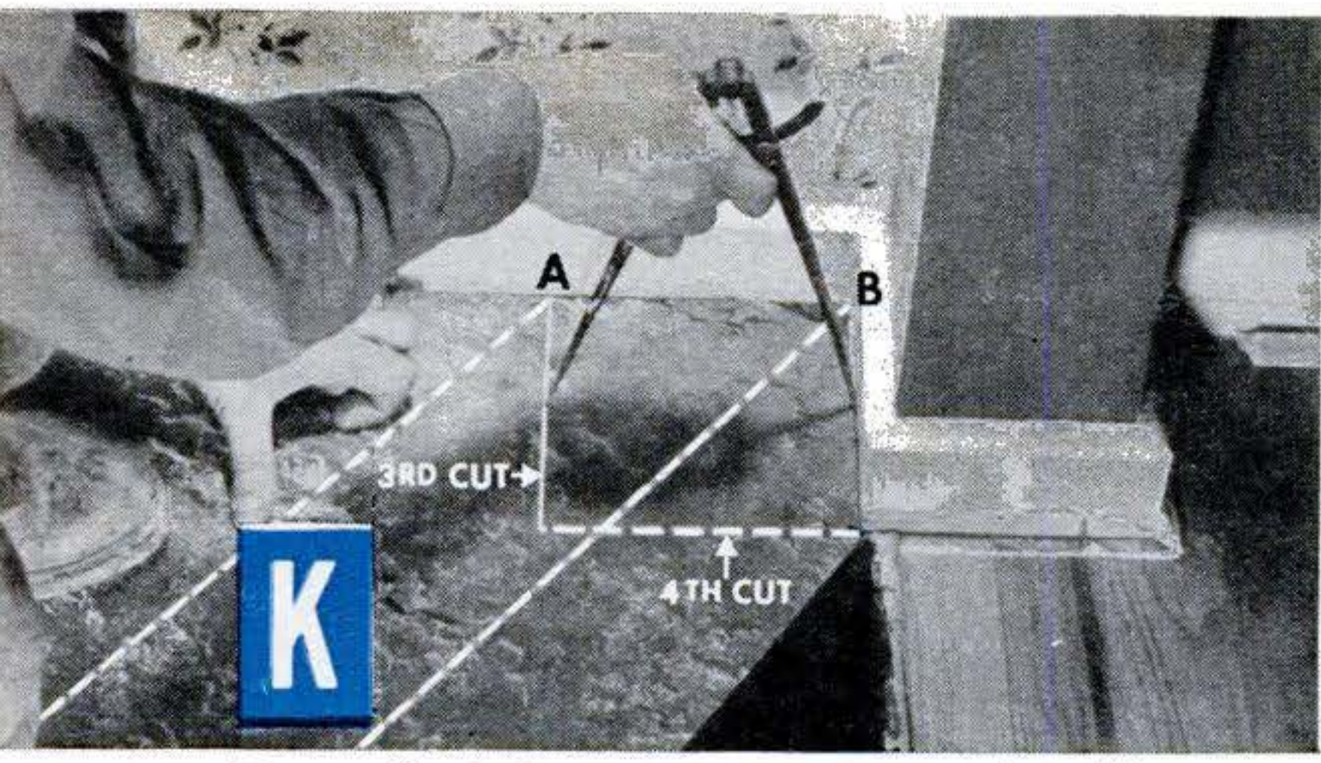
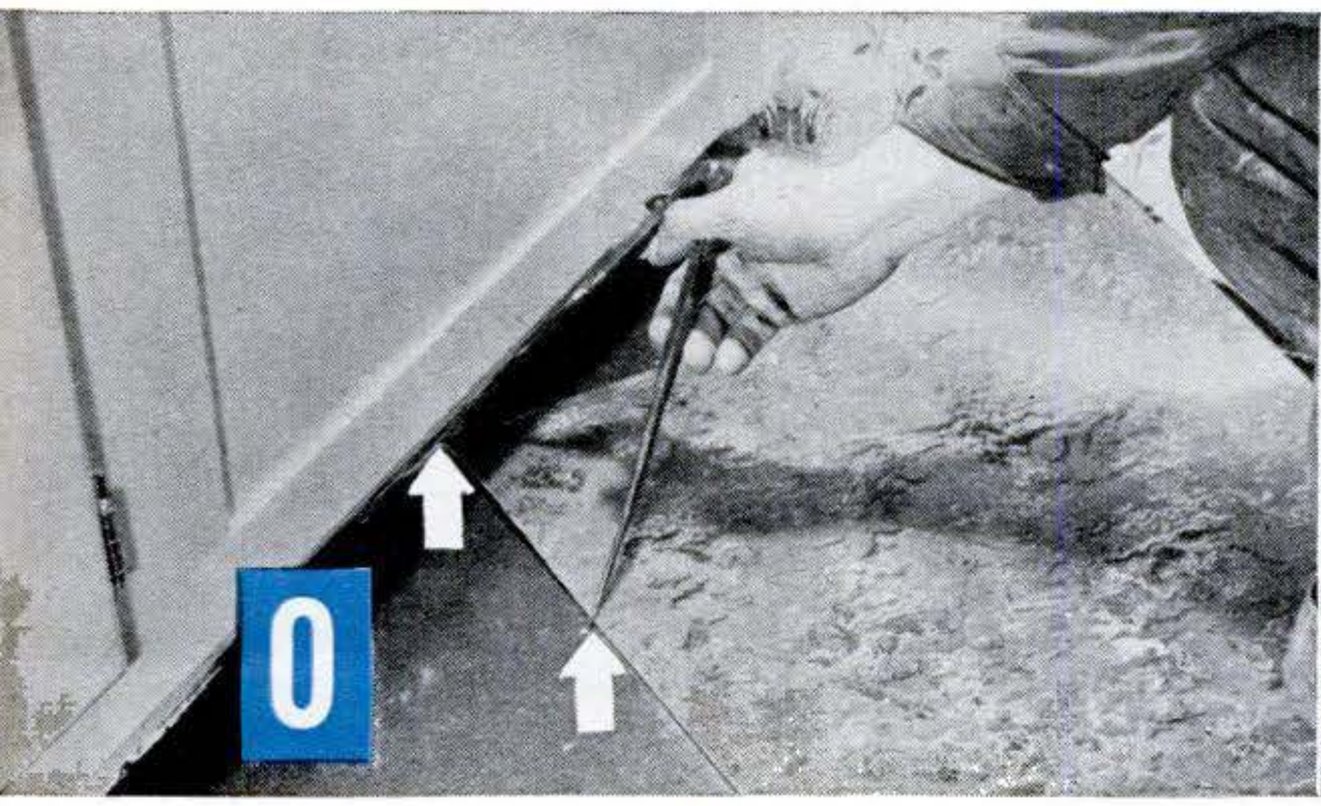
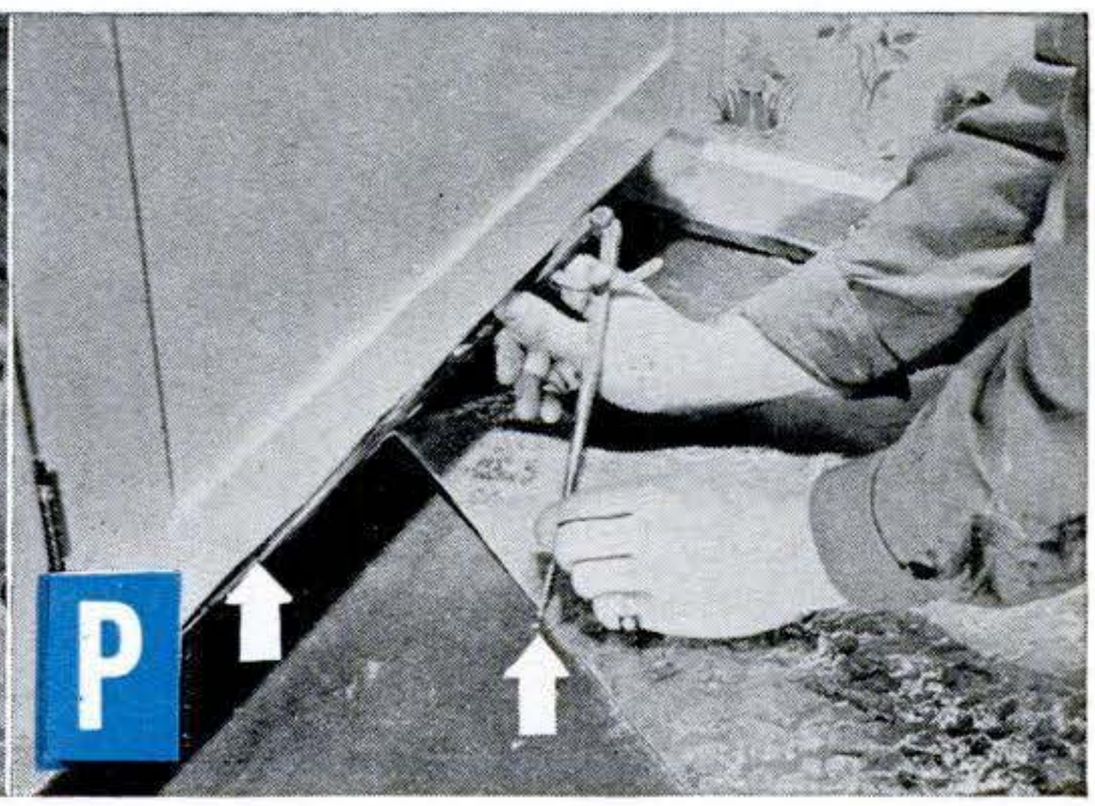


To push first cut up against end wall, strip had to be shifted to left, so centerline (A) no longer coincided with room diagonal (B). Dividers were set to distance strip had been moved (AB), and line was scribed parallel to projecting wall (3rd cut). Second line, at right angles to first, was scribed in with straightedge at end of projecting wall (4th cut).

When cut along those lines, the center strip fitted into place against the walls with its centerline matching the diagonal. If side wall had had no doorway, the same procedure would have been followed except that 3rd cut would have extended to edge of strip and 4th cut would have been eliminated.



Using that setting, the dividers were used to measure back from the corner of the linoleum strip and to mark that point on the felt. This was the first step in laying out the cut that would match the end wall.



The dividers then were reset to equal the shortest distance from that point on the felt to the wall (arrows). At that distance, a line for the first cut was scribed on the linoleum parallel to the wall. Second cut to fit side wall was laid out by same process of shifting described in photo K.

Another way is to overlap the strips and use a straightedge, placed to provide the proper strip width, as a cutting guide. One cut will trim the top strip and scribe the bottom one below it. A second cut will trim the bottom strip, and the two strips will butt neatly together.

After the strip has been rolled, the butt joint or seam should be wetted with a damp cloth and "ironed" smooth with the face of a hammer head. [*Continued on next page*]

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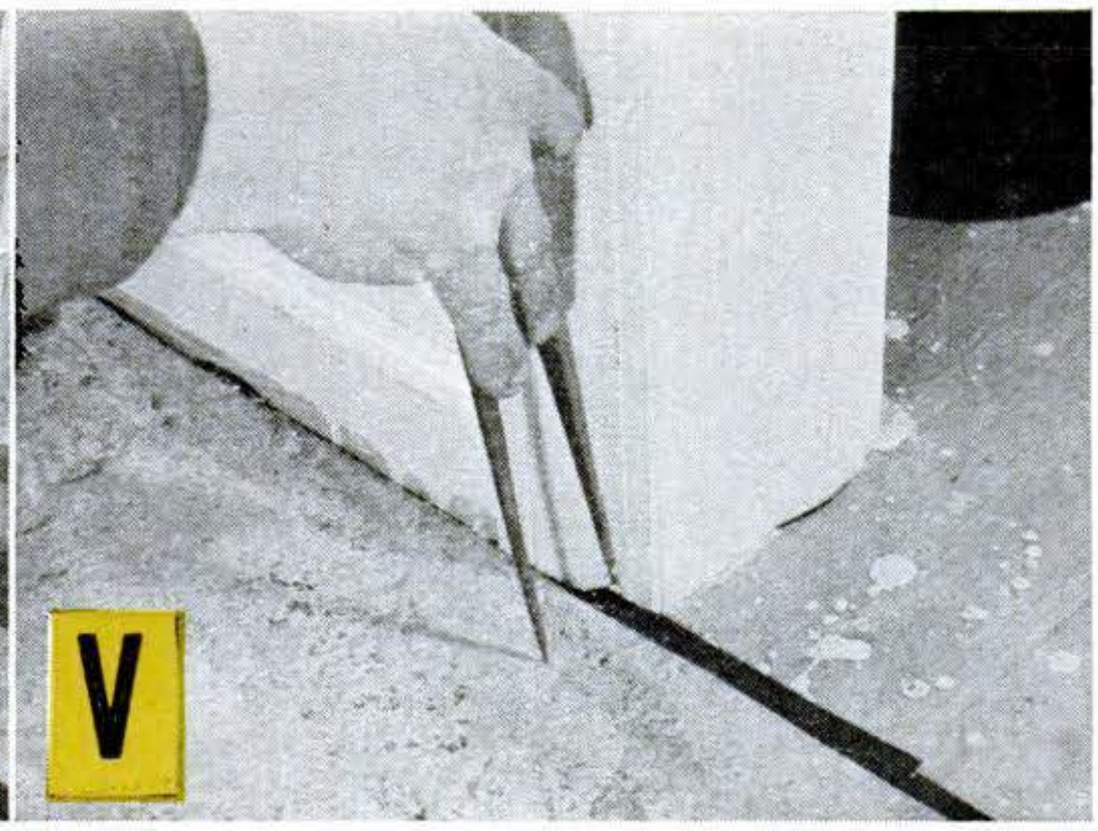
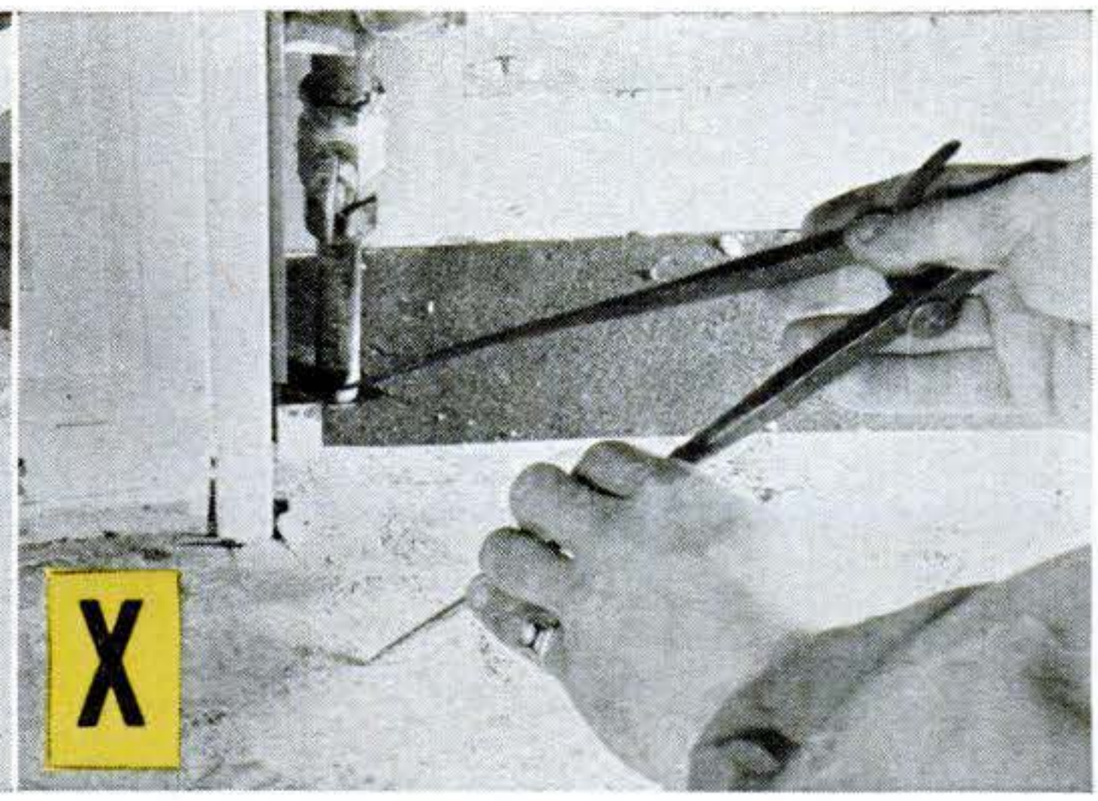
After the completed floor has been rolled and each seam has been sandbagged until the paste has dried (overnight), the linoleum should be given a coat of liquid, self-polishing wax.



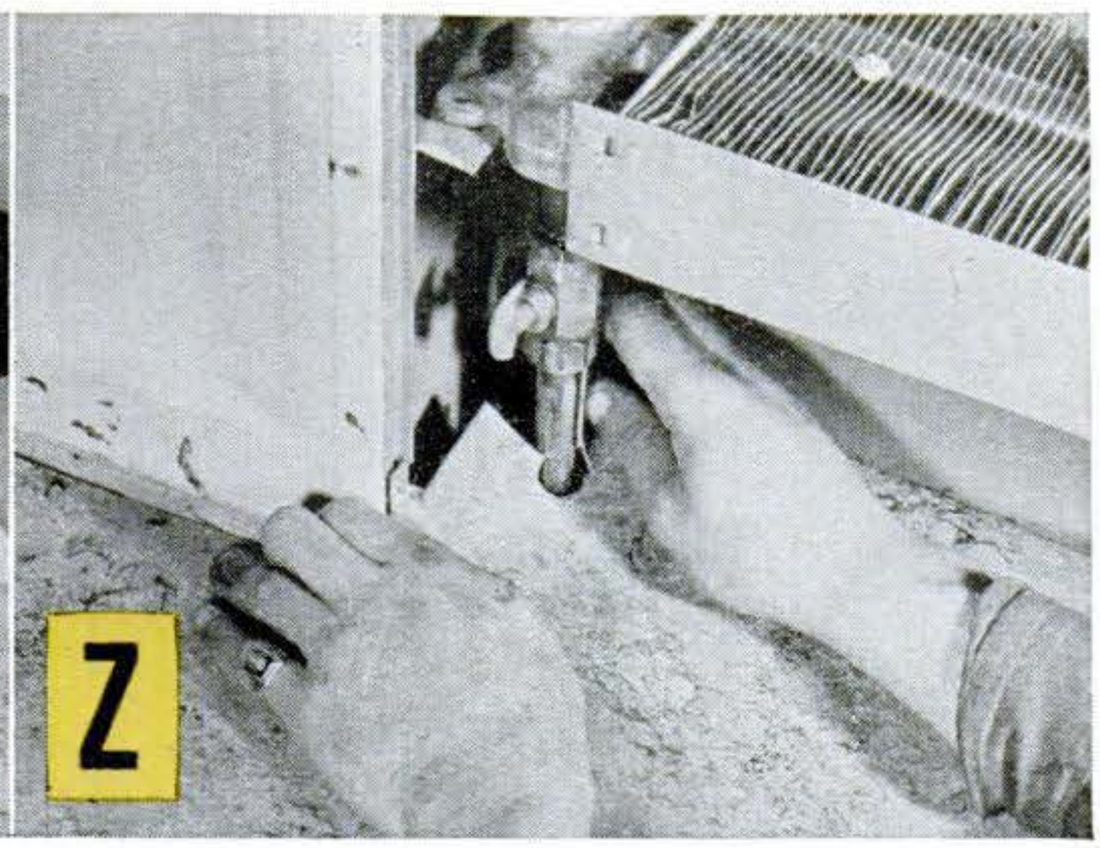
In laying full-width strips of linoleum, the same principles of laying out, cutting, and careful fitting apply. Here a pair of dividers is being used to mark a cutting line to fit around the corner of an archway.

To fit linoleum under radiators and into other recesses, set dividers a trifle wider than distance from edge of linoleum to the wall, scribe a line, and cut along it. This will allow a little extra space for any irregularities in the wall that you can't see.



To fit it around a pipe, use same setting of dividers as in preceding step, and place one point at the front of pipe and mark the linoleum with the other. This will indicate how far the pipe will extend into the linoleum and give you a reference mark for the hole for the pipe.

Using a straightedge, lay out a square and indicate the other cuts. Cut a circle equal to the diameter of the pipe within the square, and a line to allow linoleum to be pushed into place.



Here's how linoleum goes around the pipe. When there is any doubt about a fitting and cutting problem, experiment with a piece of wrapping paper first before cutting into a strip of linoleum.

END

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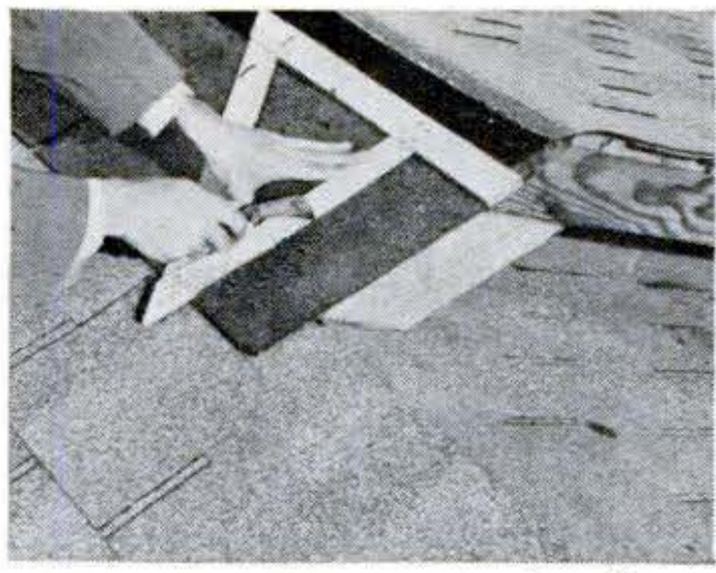
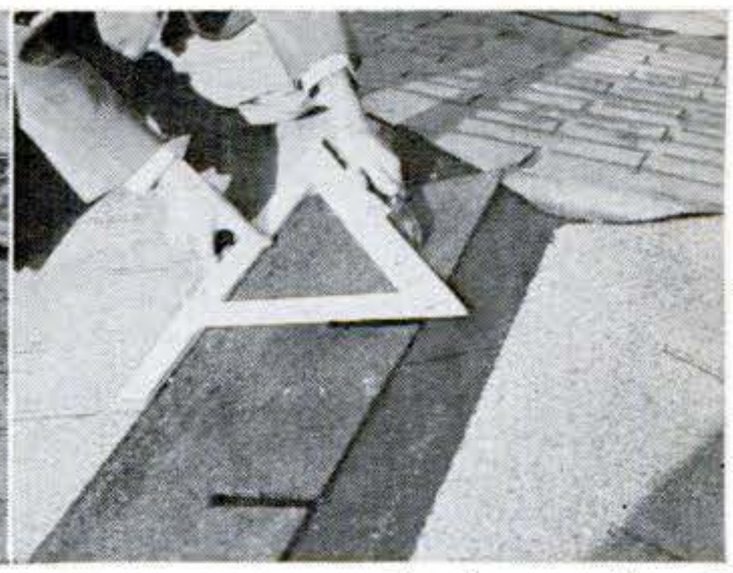
Triangle Speeds Roof-Shingling job

A FIGURE-4 right-angle triangle helps trim composition roofing shingles fast and accurately. The photos show how.

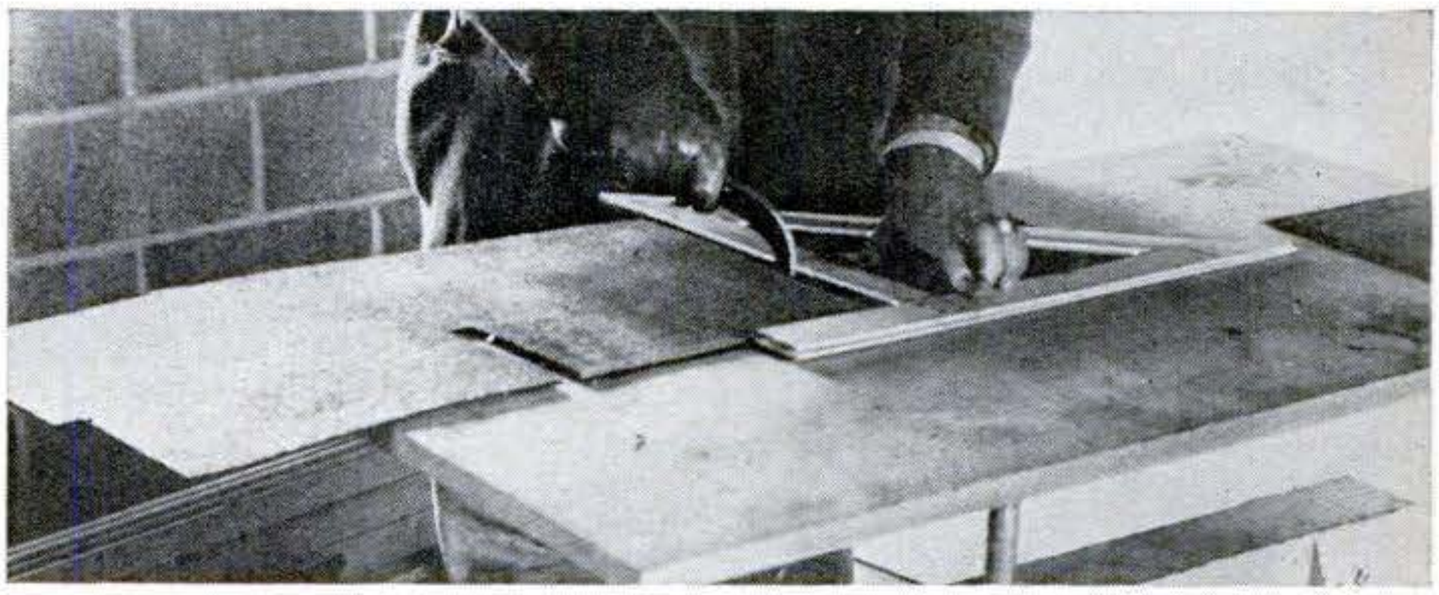
To make such a roofing aid, use Venetian-blind slats, plywood, or other thin material. The width of the members isn't important, but the thickness should be the same or less than that of the shingles, so that the base can be held against the shingle edge with the shingle on a flat surface. Make the triangle base of two thicknesses—one above and one below the joining arms—and let it extend 6" beyond the right angle. The hypotenuse slope should correspond with the hip-slope angle of your roof.—*W. G. Waggoner, Sacramento.*



The base projection is handy for gauging the 6" to be cut off the starting shingle in every other row.



Hypotenuse, the long side of triangle proper, should match the hip angle of roof for use in cutting shingles to match.



Used like T square, triangle cuts shingles square for ridge cover. An inch scale may be scribed on base for convenience.

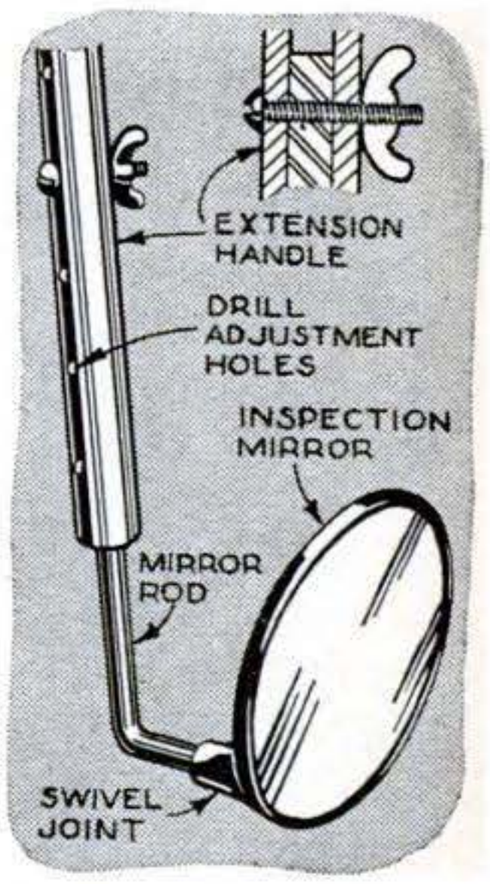
My Most Ingenious Solution

My 40-foot boat had almost as much water in it as there was outside it. Bailing with a hand pump or pail was out—too much work. How do you think I got the water out?

I borrowed a 1-hp. outboard motor and some stovepipe. I clamped the outboard inboard, ran one end of the stovepipe to the propeller, and stuck the other end over the gunwale. When I started the outboard, the prop pushed the water through the stovepipe and out of the boat.—Ivan Johansen, Ontario, Canada.

Bike Mirror "Inspects" Machinery

A SWIVEL-JOINTED bicycle mirror fitted with an adjustable extension handle will enable you to see behind and under machines, between walls, or around heavy fixtures. To extend reach of the mirror, slip a length of close-fitting fiber or metal tubing over the handle as shown.—*Fred Lettino, Astoria, N. Y.*



Cable Sheathing Protects Tubing

WHEN small-diameter copper or brass tubing must be used in exposed places where protection is required, BX cable sheathing is often satisfactory. Draw out the wire and insert the tubing, as shown in the photo at right. The metal BX sheathing is so flexible that it can be bent with the tubing inside it.—*R. Hanscom, Elmhurst, Ill.*

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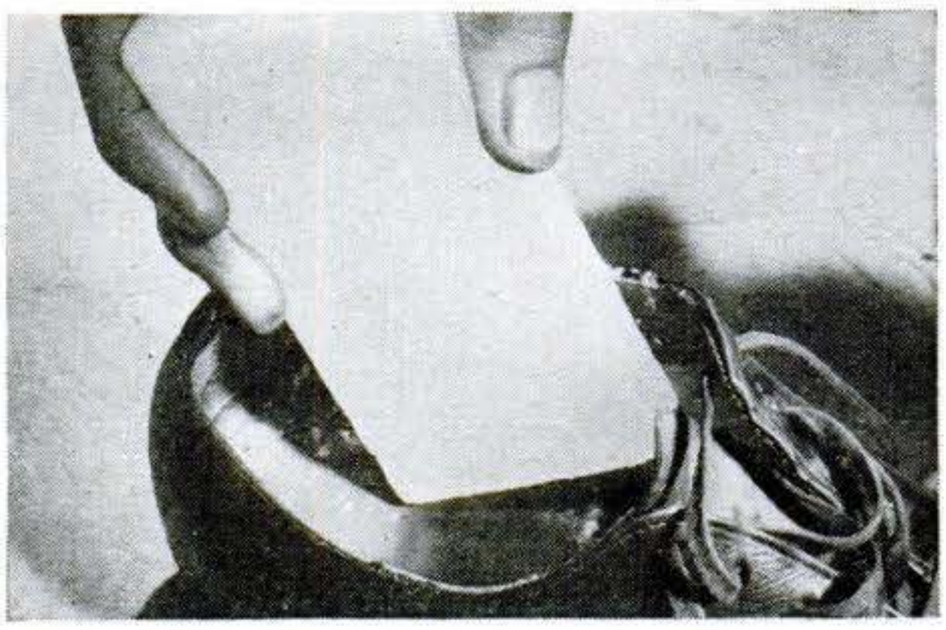
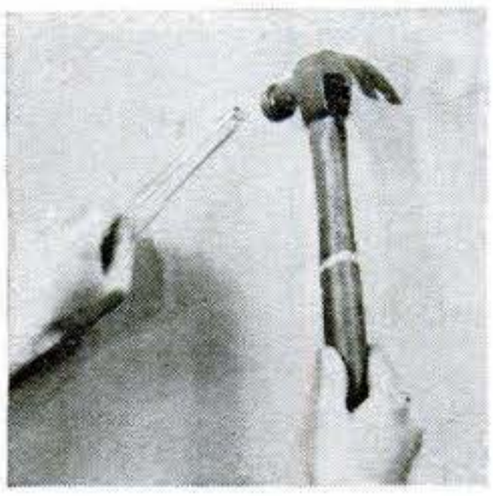
DO IT THE EASY WAY



If a shoe blisters your foot, try this: Rub paraffin on the shoe's rough spot. Repeat the treatment for several days and sprinkle talcum powder on the spot.

If your pipe stem fits tightly, making it difficult to remove for cleaning, try this: Rub the point of a soft lead pencil on the shank to lubricate it.

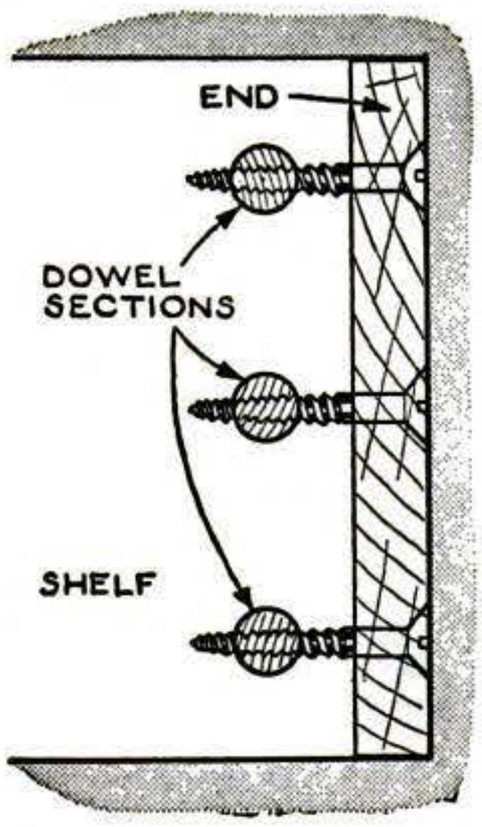


If it's hard to reach the spot where you want to drive a nail, try this: Bend a pipe cleaner around the nail to hold it, start the nail, remove the cleaner, and finish hammering.

If your medicine dropper is liable to be knocked off a table or mislaid, try this: Slip an ordinary pencil clip over it and clip it to the edge of a drinking glass.

Dowels Anchor Screws in Soft Wood

WHERE screws must be driven tightly into the end grain of very soft wood, or into wood where there are splits or old screw holes, the method illustrated will give better anchorage. Turn the screws through the dowels and they will take firm hold.—*J. S. Hatcher, Falls Church, Va.*



Corrugated Strip Holds Pen Nibs

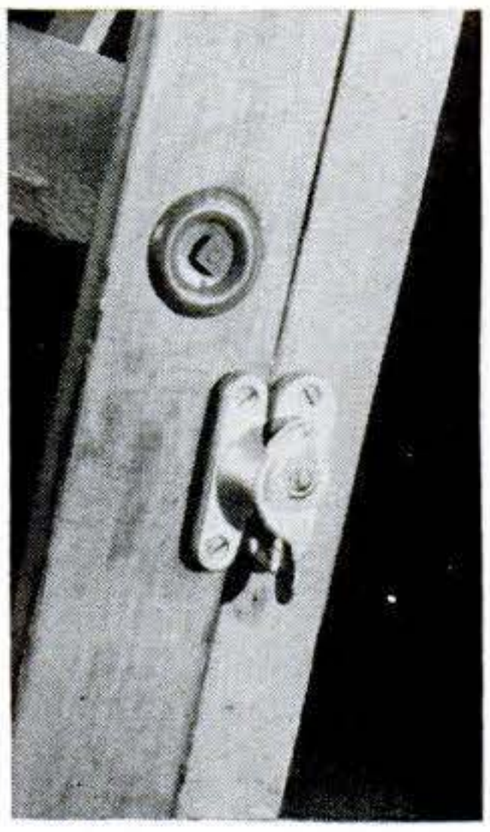
TO KEEP lettering-pen nibs handy and ready for easy selection, insert them in corrugated paper wrapped around the ink bottle. The corrugated strip should be slightly shorter in length than the circumference of the bottle. Secure the ends with cellulose tape.—*John J. Rea, Urbana, Ill.*

Cement Grips Undersize Screws

RECENTLY I had a job to finish and ran short of some special shouldered machine screws. The only similar ones I had were about .002″ undersize. Recalling an old toolmaker's dodge, I mixed litharge and glycerine to the consistency of thin putty. I spread it thinly over the threads and screwed the parts together. After two weeks of drying, I tested the job. None of the screws could be loosened with a screwdriver—*H. P. Boettcher, Jersey City, N. J.*

Window Lock Locks Ladder Legs

A STEPLADDER can be awkward for one person to carry. To prevent the legs from spraddling apart, I attached an ordinary window lock that holds the legs together when I move the ladder. I screwed the lock near the bottom of the legs.—*Mrs. Eleanor Tilden, Altadena, Calif.*



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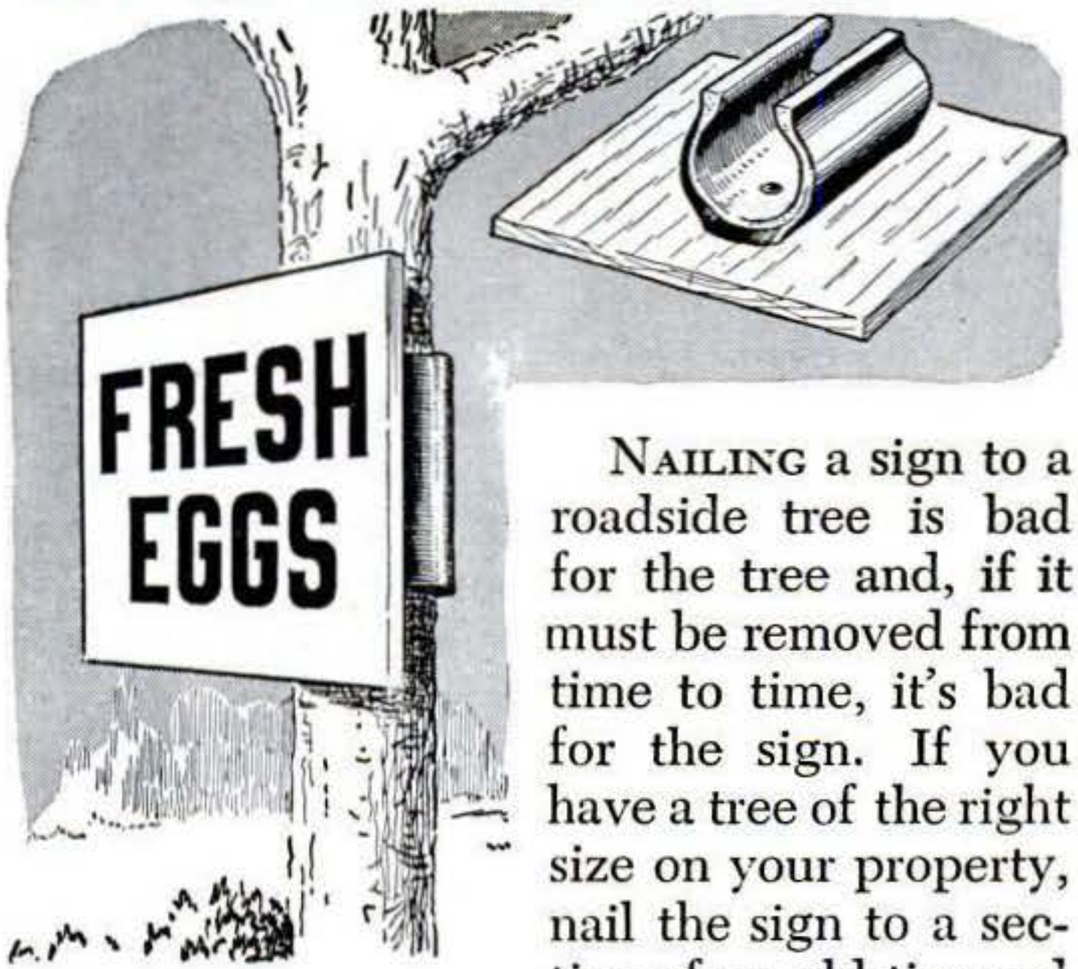
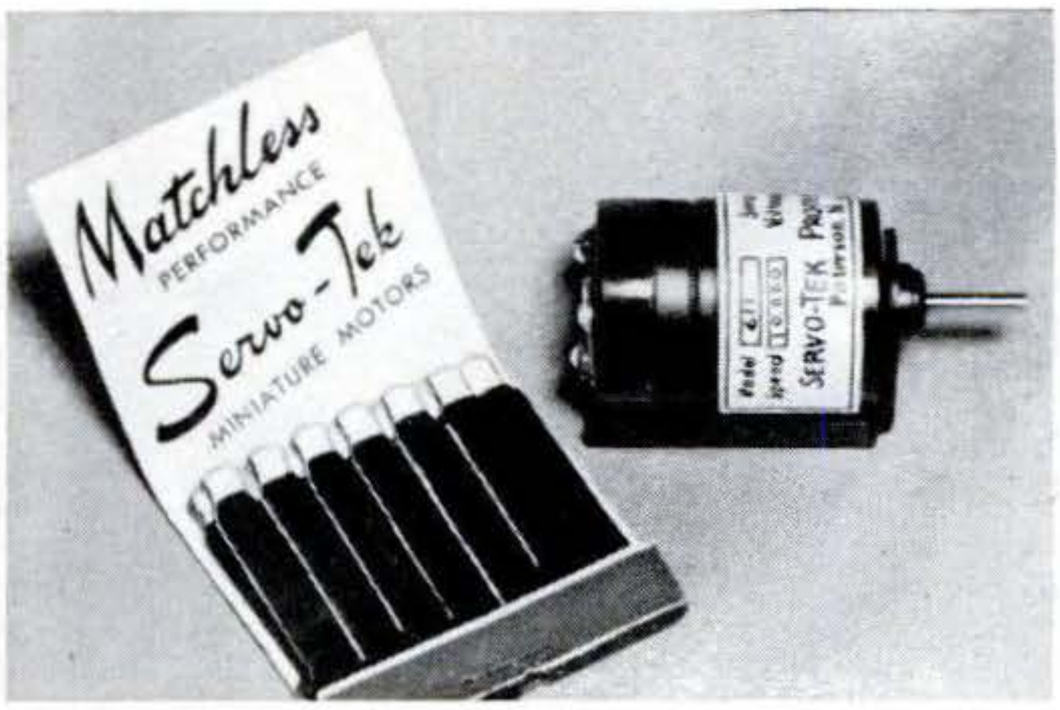
This Sign Won't Injure the Tree



NAILING a sign to a roadside tree is bad for the tree and, if it must be removed from time to time, it's bad for the sign. If you have a tree of the right size on your property, nail the sign to a section of an old tire and clamp it around the tree trunk.—*Ervin L. Strayhorn, Beebe, Ark.*

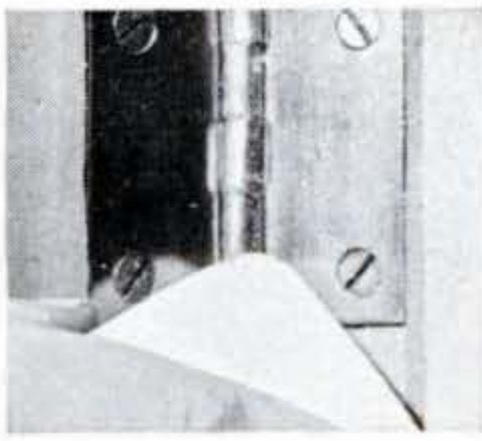
Miniature Motors Fit Many Jobs



A NEW line of tiny motors offers units suitable for model work or use in small blowers, aircraft-control equipment, and the like. The line, made by Servo-Tek Products Co., Paterson, N. J., includes DC voltage ratings from 6 to 28, a choice of standard or high-altitude brushes, and two mounting styles. The motors weigh about 2½ oz. and measure 1⅛″ in diameter by 1½″ in length. All models have ring-type Alnico field magnets and ball-bearing drives.

Soap Kills Squeak, Saves Clothes

PUTTING a little oil on the hinges of a closet door when they squeak takes care of the noise, but doesn't do your clothes any good if they accidentally touch the oil. A little soap works just as well and is non-spotting.—*R. F. Donovan, Guttenberg, N. J.*

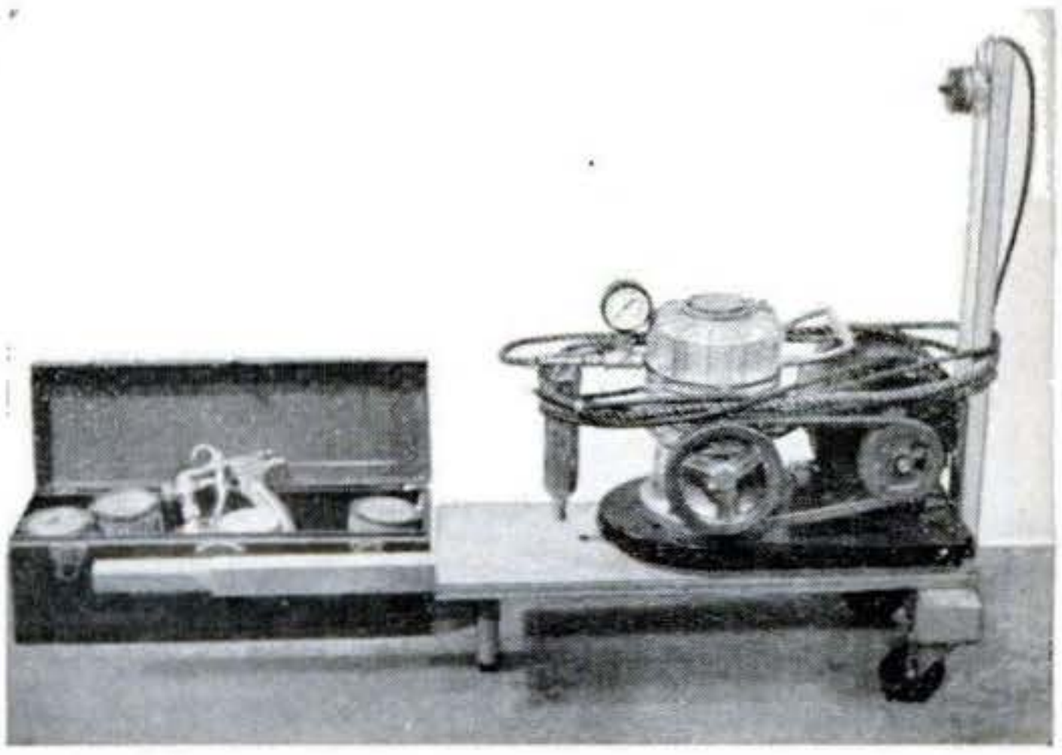


Sprayer Placed on Dolly Can Be Hauled to Job

FASTENED to a platform that has two big casters at one end and short legs at the other, my paint sprayer is now a mobile unit. It vibrates and creeps less than it did on the floor. The switch, mounted on a wooden upright, is easy to reach.

The compressor shown came with spring-mounted rubber feet. I detached the feet, fastened them to the ¾″ plywood platform, and remounted the compressor on them.

A box for the gun could be built right on the dolly. The handle could be hinged and the switch mounted near its end and connected with a flexible wire loop. When locked in a vertical position, the handle would serve the purpose of the other upright shown.—*Herbert Pfister, New York City.*



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Gus Solves One for the Judge

With the Judge's car on trial for malfeasance, the Model Garage owner cross-examines and renders a decision.

By Martin Bunn

GUS WILSON never will understand why so many car owners always put off necessary car repairs until the last moment. Take the business of getting their cars ready for vacation trips. It's the same way every year. Come June, and the first hot spell, and the folks in our town descend on the Model Garage in droves and expect Gus to put their cars in shape overnight. Gus doesn't mind working late on an emergency job, but he hates like the devil to give up his evenings doing work that could have been done weeks before.

This year has been no different. A few afternoons ago, after a particularly hectic morning spent dealing with customers who were in a hurry, Gus looked at the cars lined up on the repair-shop floor and groaned.

"There's more rush work stacked up here right now," he grumbled to Stan Hicks, "than we can handle in . . . "

Just then the jingle of the office phone interrupted.

"I'll get it," said Stan.

A few minutes later Stan came back out of the office.

"That was Judge Tate's wife," he explained to Gus, who had started to work on

one of the cars. "She's stuck down near the savings bank. Claims something exploded under the hood when she tried to start the car. She sounded scared and wants someone to come right down."

Gus didn't answer. He didn't even look up from the row of spark plugs he was cleaning and adjusting. After several moments of silence, Stan said, "Well, what do we do, boss?"

"Oh, go on down," Gus grumbled. "We're so far behind in our work now that one more car won't matter."

About 20 minutes later Gus heard the wrecker pull up and stop outside the shop doors. "Well, what was wrong with the Tate car?" he called as Stan entered the shop.

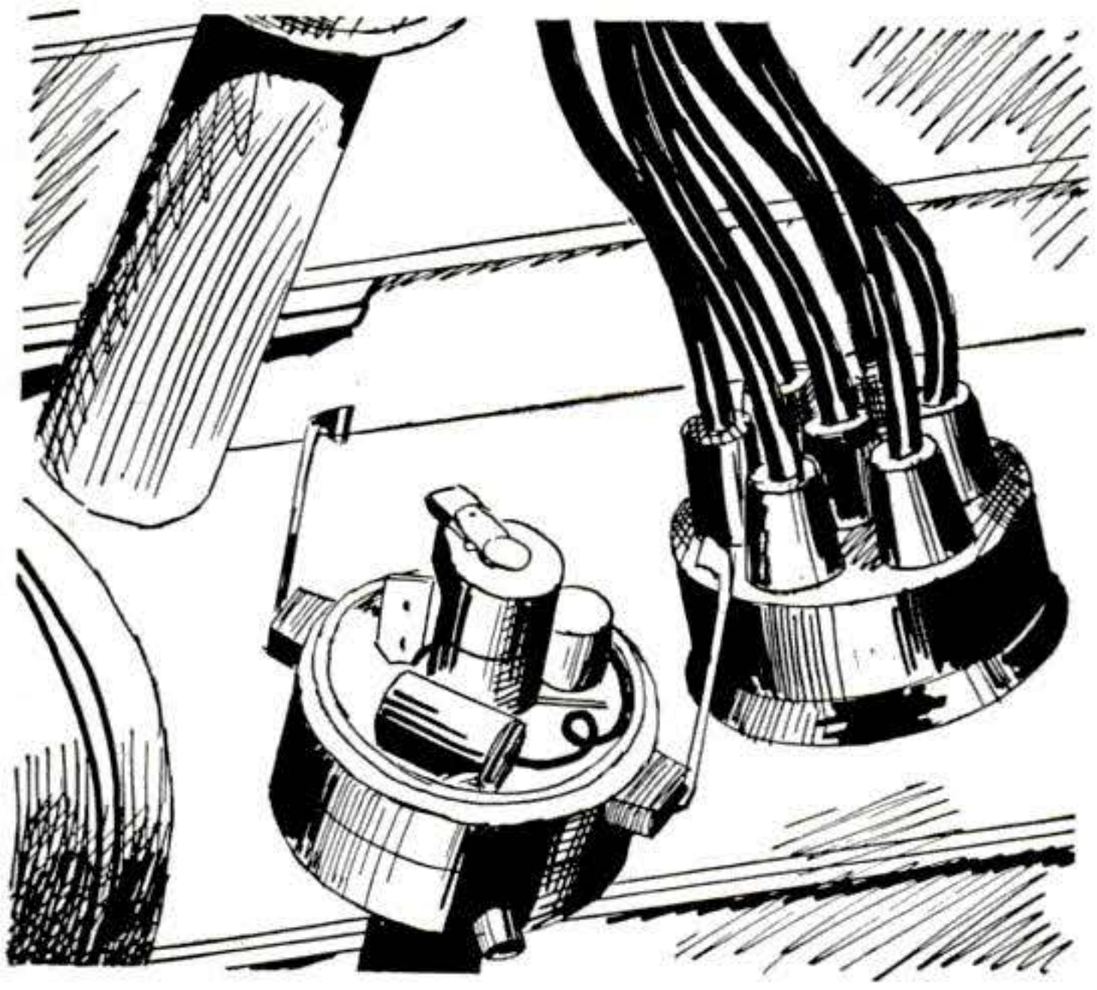
"Blamed if I know, but it's running okay now," Stan reported. "When I got there, I pushed the starter button and when nothing happened, I got out and opened the hood. The cap was completely off the distributor and dangling by its wires. I snapped it back into place, tried the starter again, and the motor caught right away. That's all there was to it."

"What did you do then?" asked Gus.

"What do you mean, what did I do then?" Stan asked, puzzled. "I told Mrs. Tate that the car was all right. What else?"

"But Stan, you know distributor caps just don't come loose of their own accord. Didn't

As Judge Tate got behind the wheel of his car, Gus Wilson raised the hood. "Okay, now start her up," he called out.



you try to find out what made it come off in the first place?"

"Well, you see, boss," Stan explained, "I figured that the loud 'pop' she claimed she heard was probably some other car backfiring. You know how dames are when it comes to car noises. As for the distributor cap, I figured it had either jiggled loose or some wise kid had taken it off just to see the fun."

Gus looked at Stan and shook his head. Then he said, "Well, I'll bet you a buck against a broken wrist pin we'll be hearing from the Tates again."

For a time it looked as if Stan might win the bet. They hadn't heard a word from the Tates. Then, one evening, just as Gus was getting ready to close up shop for the day, a car pulled up in front of the garage. Old Judge Tate was at the wheel.

Stan Loses

"Good evening, Judge," Gus greeted the elderly man as he walked toward the car. "Something we can do for you?"

"I hope so," the Judge replied smiling. "I've been having trouble with this car, and this is the first chance I've had to bring it around. It all started about a week ago."

"That the time Mrs. Tate got stuck down near the bank?" Gus asked, expecting some sort of rebuke for Stan's failure to find out what actually was causing the trouble.

"Precisely, and your man was kind enough to come down and get the car started for Mrs. Tate," the old Judge replied mildly. "He found that the distributor cap had come loose."

Gus nodded.

"Well, oddly enough," the Judge went on, "it's happened to me several times since when I've tried to start the car after it's been parked for a short time. Each time it's happened just after I've pushed the starter button. There's a loud 'pop,' and when I lift the hood I find that the distributor cap is off. Once I put it back, the engine starts easily."

"Have any trouble starting it first thing in the morning?" queried Gus.

"No, not particularly," replied the Judge.

"Well, let's drive her into the shop and have a look."

When the Judge had eased his sedan to a stop in the middle of the repair-shop floor, he set the hand brake, and turned off the ignition. As he opened the door, Gus motioned to him.

Trouble Won't Perform

"Stay right there, Judge. I want you to start and stop the engine for me a few times. Stan's gone for the day, so you'll have to pinch-hit."

As he talked, Gus walked around to the front of the car and raised the hood. "Okay, now start her up," he called to the Judge.

The engine started right up, and Gus didn't notice anything out of the ordinary as he peered under the hood.

"All right, now stop her, wait a moment or so, and start her up again," Gus directed.

The Judge did as Gus told him. There still were no signs of trouble, so Gus signaled for the ignition to be turned off.

"I guess you think I've been imagining things," Tate said, grinning, as he joined Gus at the side of the opened hood.

"Not at all," Gus assured him. "Automobiles are like kids and television sets—they won't do the right thing when you want them to show off."

As Judge Tate watched, Gus reached in and began removing the cap from the distributor. "These spring clips could be tighter," he said as he unlatched the cap and turned it bottom side up so he could see the contacts. "Had any work done on this distributor lately?"

Stan Takes a Kidding

The Judge thought for a moment. "Well, come to think of it," he said finally, "a mechanic where we spent our vacation last summer put in a new set of ignition wires for me and he made some comment about filing the distributor points."

"Judge, do you suppose you could leave the car here?" Gus asked. "I want to give

[*Continued on page 210*]

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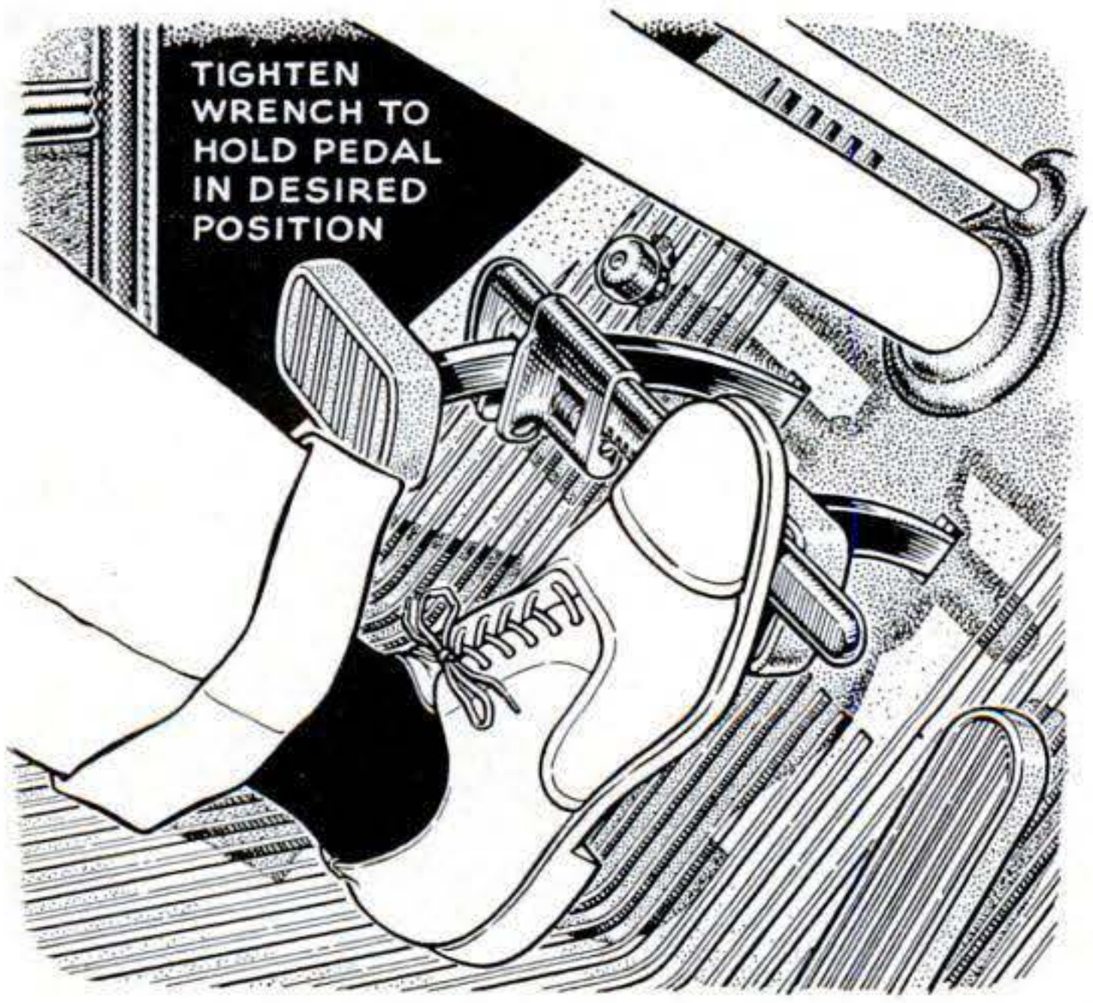
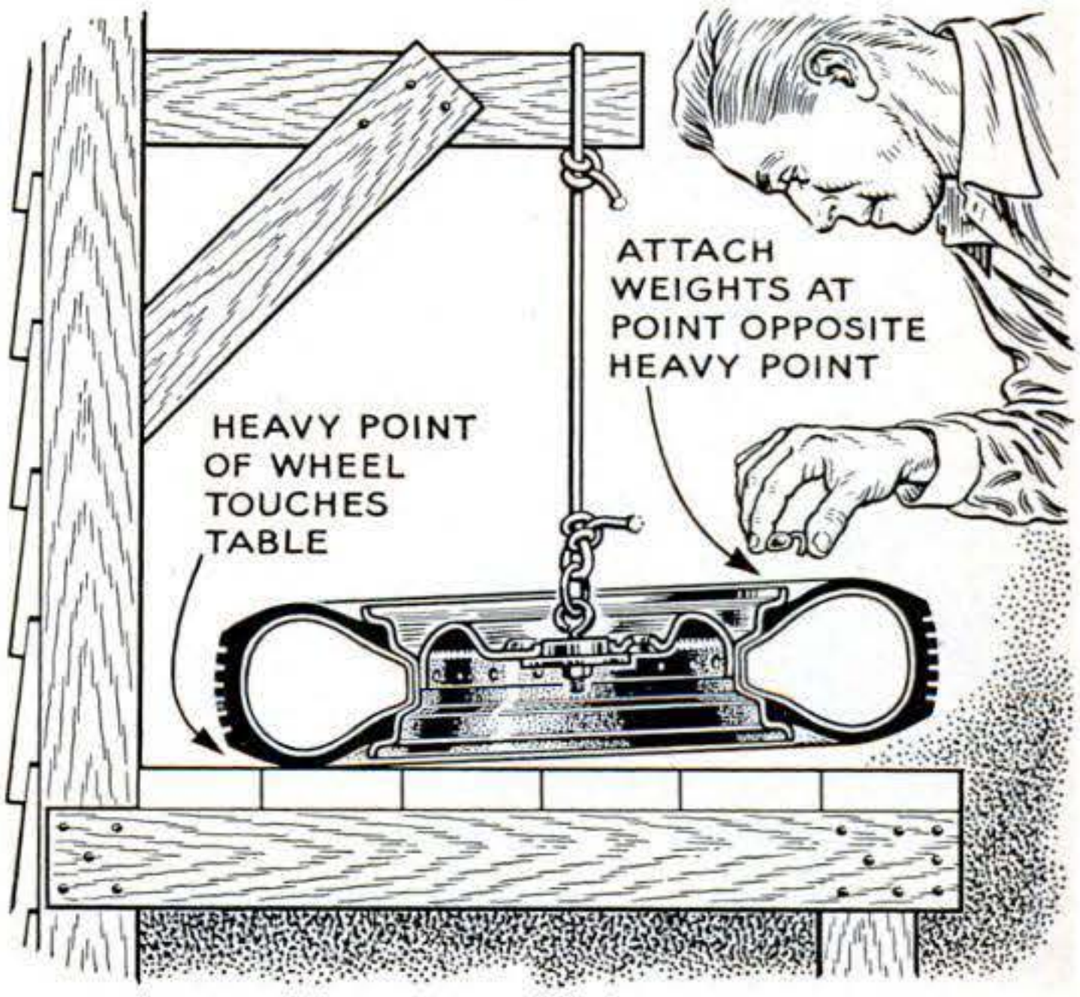
Hints from the Model Garage

A Pipe Rack in Your Car. A piece of inner-tube rubber between two suction cups on windshield or dash makes a convenient pipe rack. Use cups with threaded shafts. Make holes in the rubber, slip it on the shafts, and tighten the nuts.

End Wrench Spreads Tire. It's difficult to apply a patch to the inside of a tire casing without a tire spreader. As a handy substitute, take a large open-end wrench and prop the sides of the casing apart as shown in the drawing above.



Wrench Holds Down Pedal. When it's necessary to keep the brake or clutch pedal depressed while you are working on a car, a large adjustable wrench does the job conveniently. With the pedal depressed, place the wrench handle against the pad and tighten the jaws on the shank of the companion pedal.



Balancing a Wheel. If carefully assembled, this rig will let you correct the static balance of your wheels. Mount a support arm over a leveled table or bench. Make a shouldered disk with a support ring that just presses into the wheel center. This must fit exactly to keep the hook-eye centered. Use rim weights to level the wheel.

Turn the page, please, for eight more auto hints.

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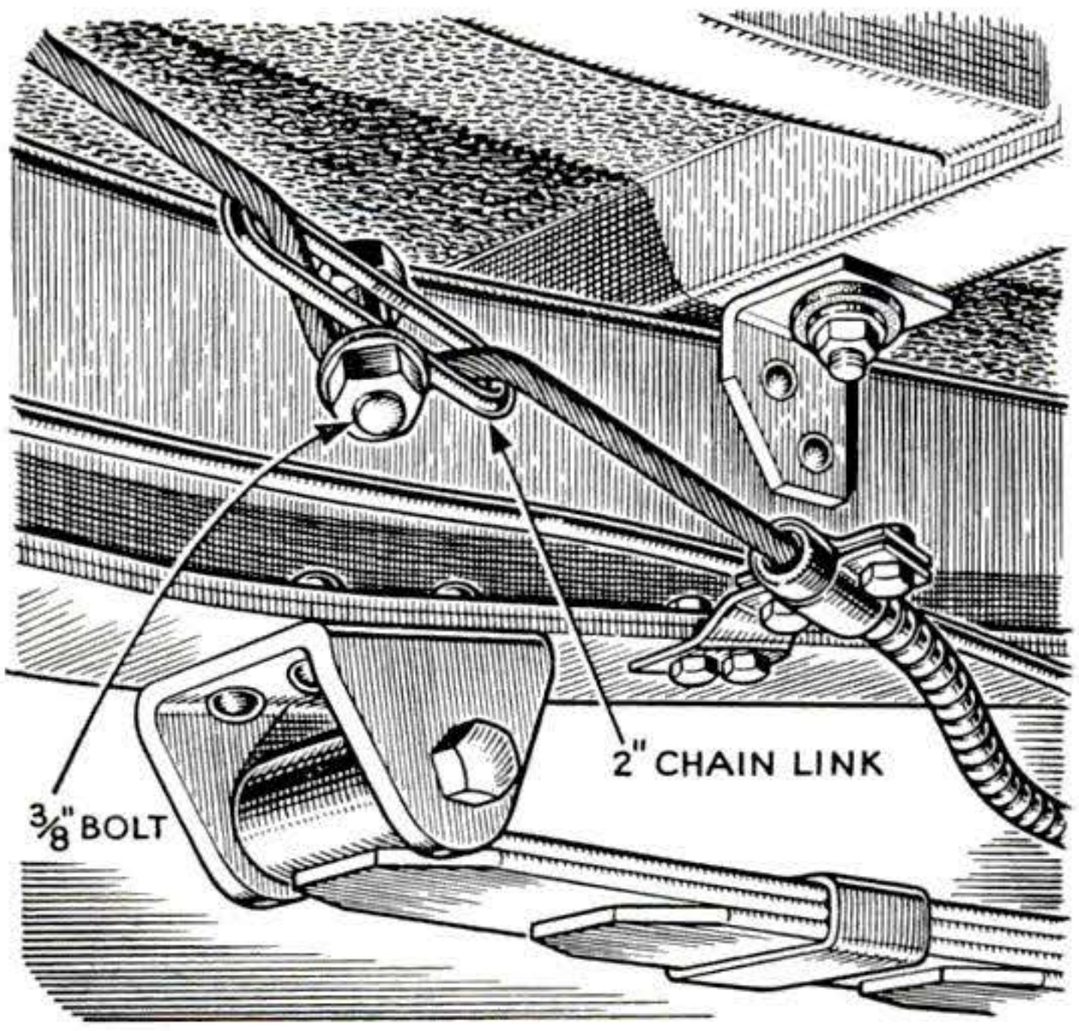
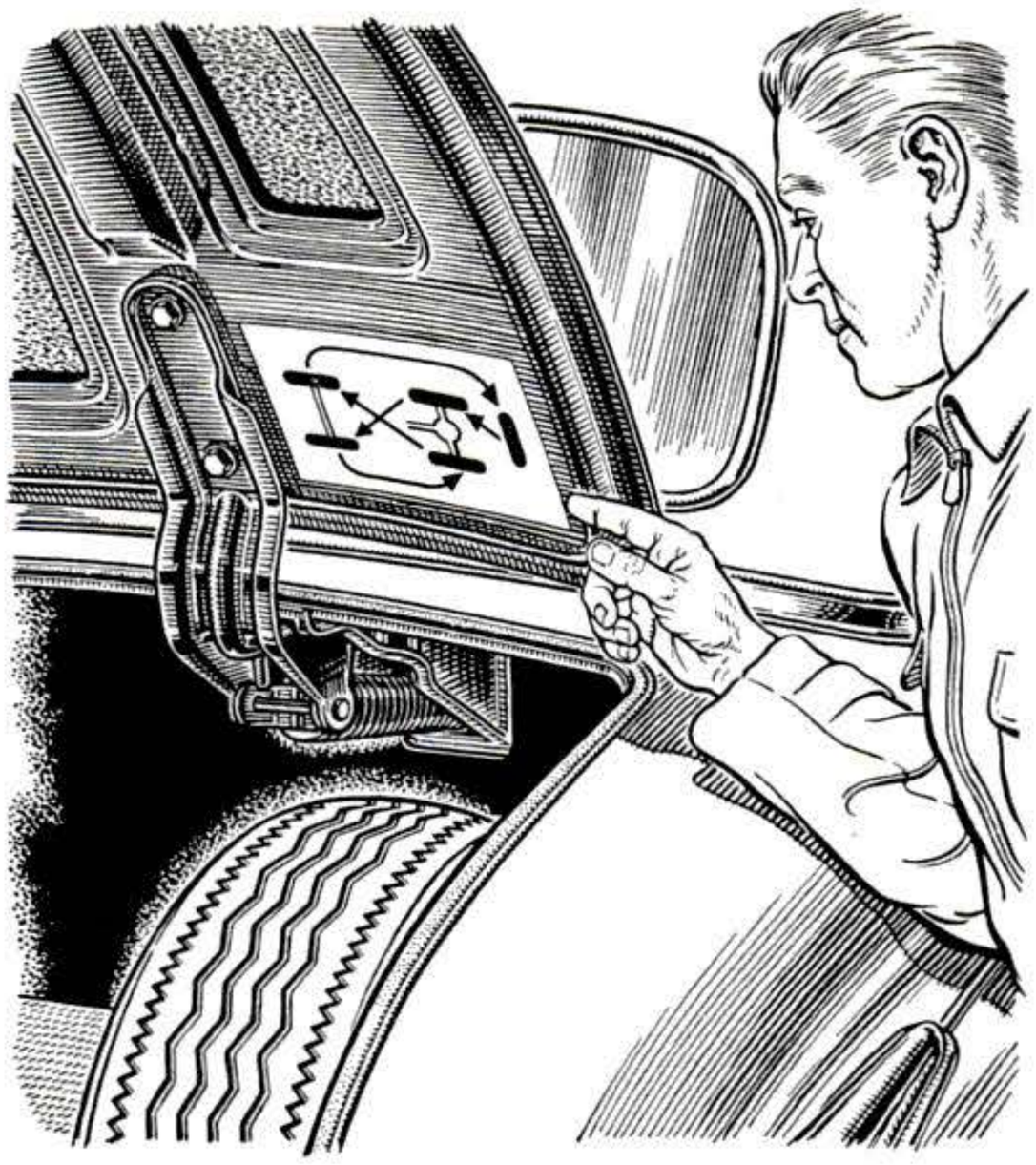
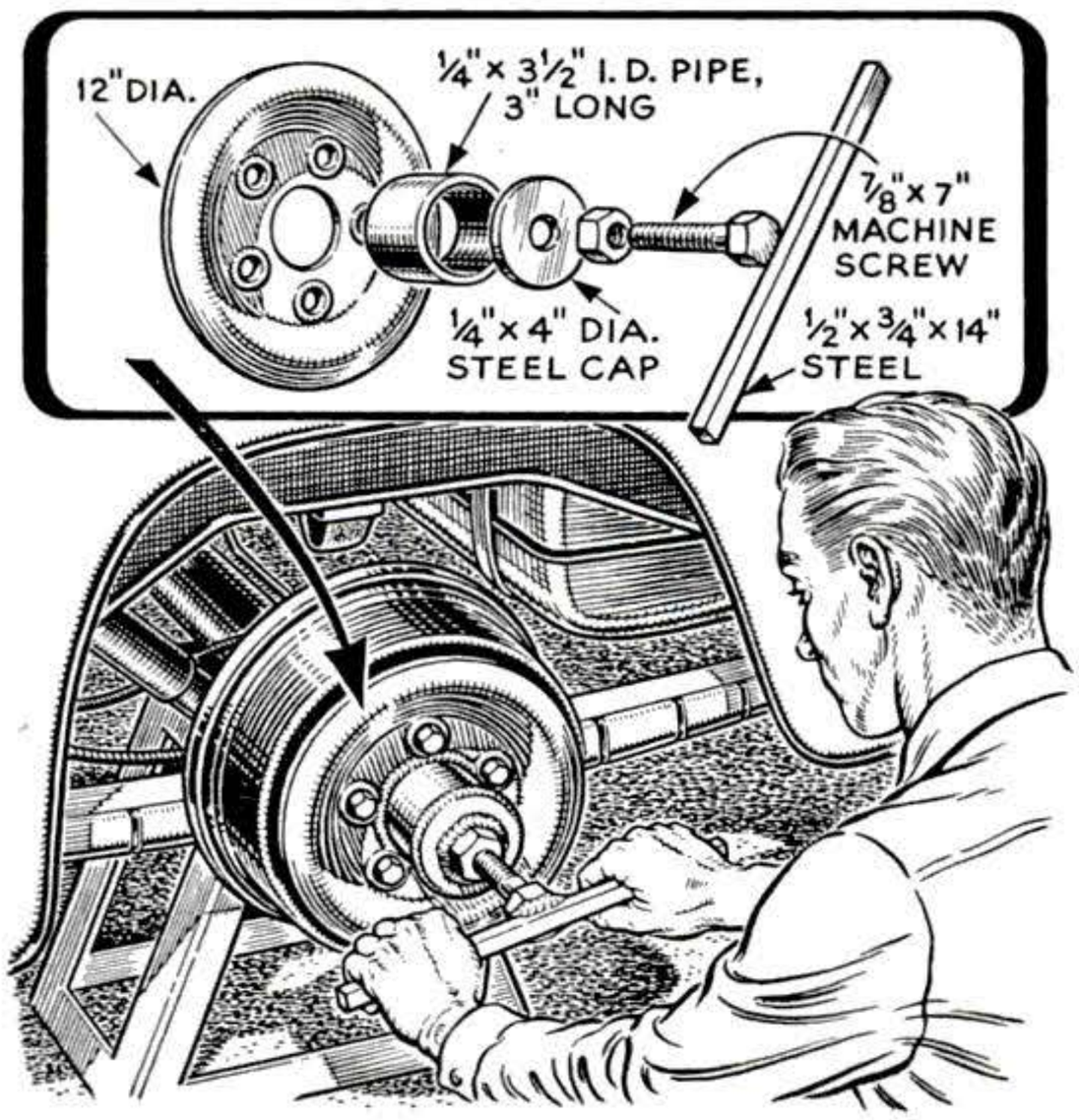
MORE Hints from the Model Garage



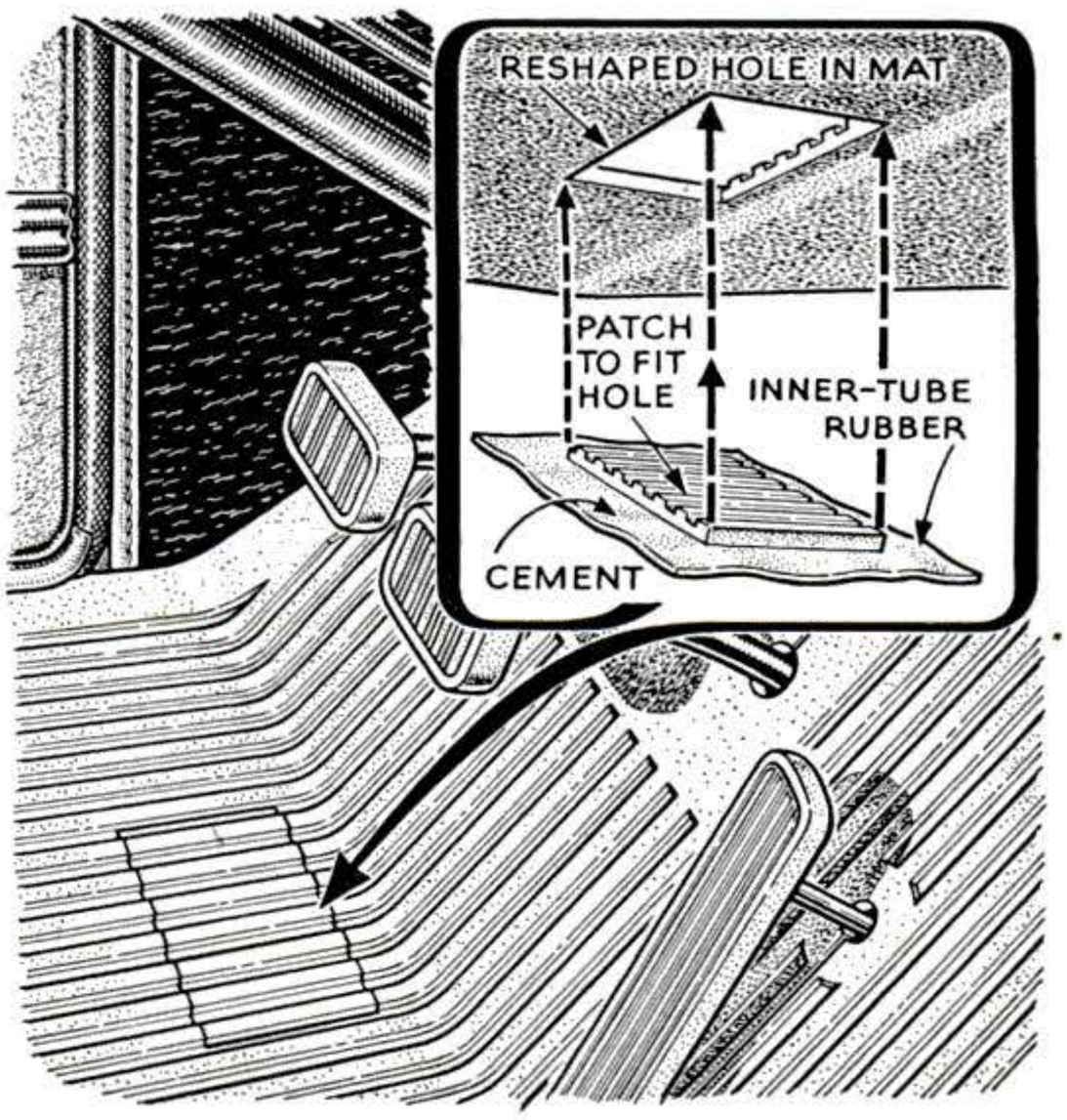
Tightening a Brake Cable. In some cases, you can take up slack in a parking-brake cable as shown here. Be careful to locate the chain link and bolt in a free area so that they will not interfere with the travel of the brake cable.



Rotation Chart Guides Mechanic. Different garages may rotate tires in different patterns. To make sure yours are transposed in the same way each time, cement a diagram under the trunk lid. Instruct the mechanic to follow this pattern.



Homemade Wheel Puller. Find an old wheel that will fit the car and burn off the rim with a torch, leaving just the center disk. Weld the pipe to it, the cap to the pipe, the nut to the cap, and the handle to the screw head. To pull a drum, remove the wheel nut, attach the disk, and turn the screw against the spindle.



Patching a Floor Mat. A worn floor mat can be patched with a piece cut from a rubber stair tread or a discarded mat of similar pattern. Cut the mat hole square or rectangular and trim the patch to fit. Cement the patch to a larger sheet of inner-tube rubber. Then cement the rubber to the underside of the mat.

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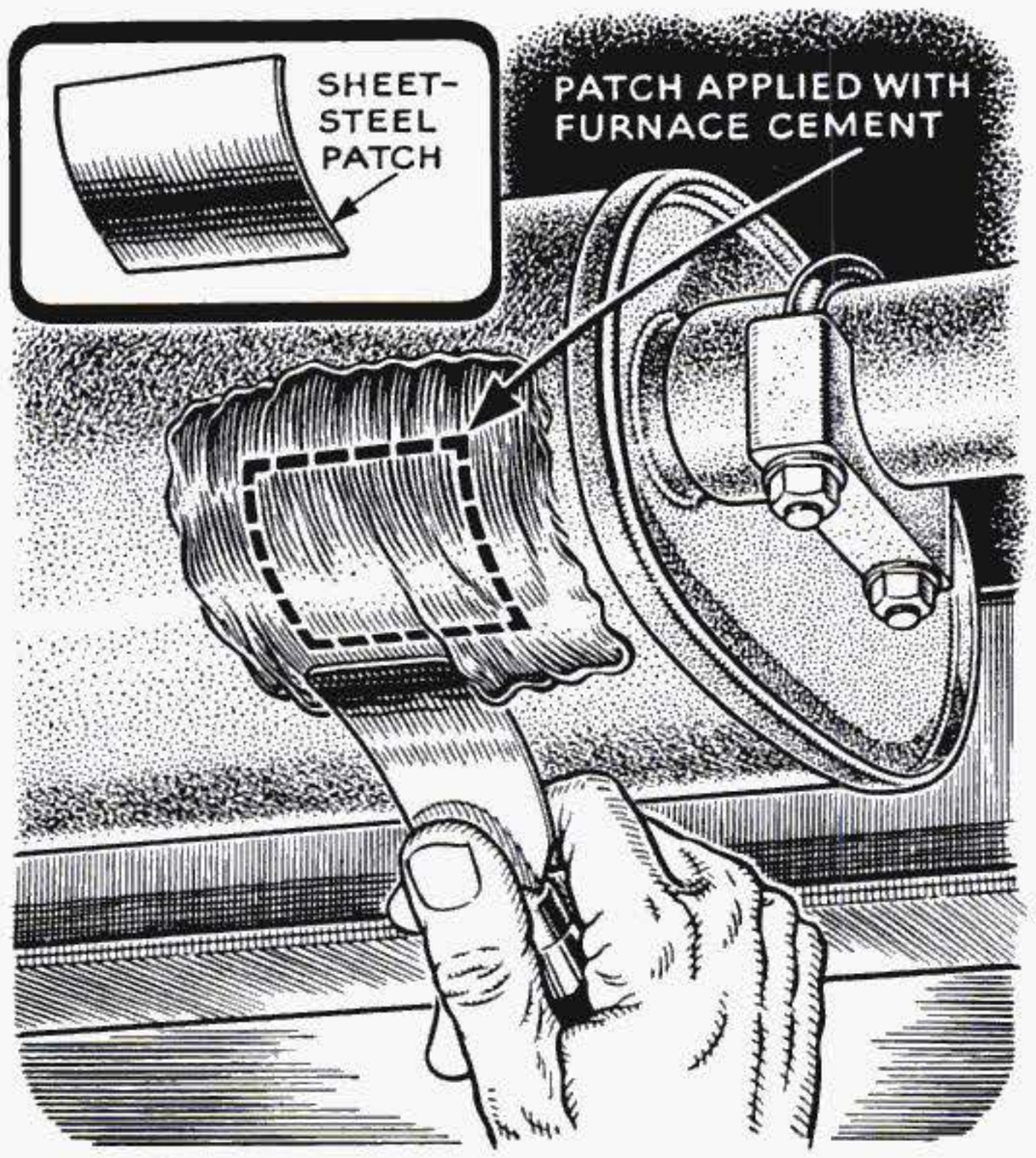
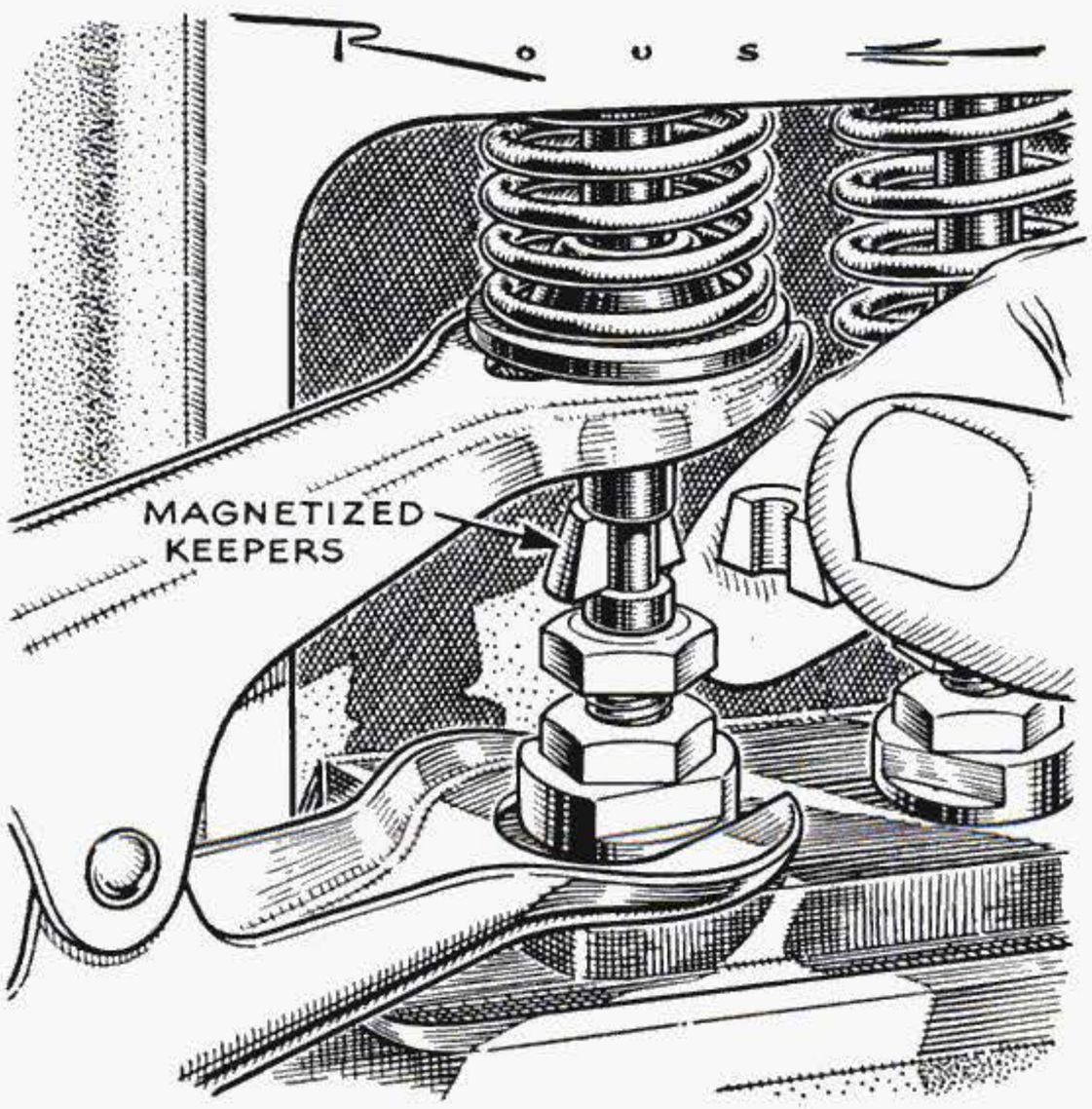
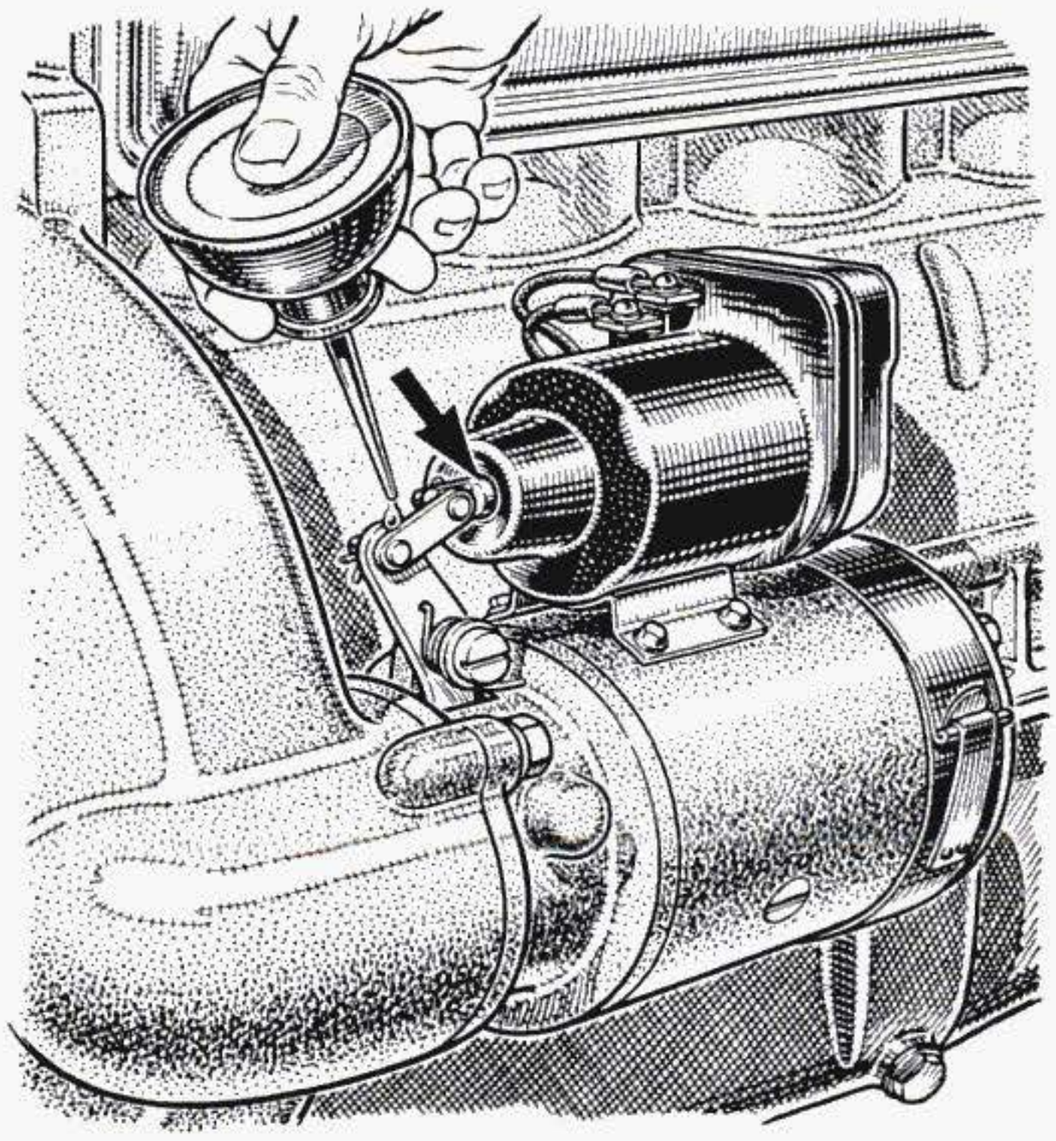


One Way to Repair a Muffler. You may save the price of a new muffler by using a little furnace cement. Clean the area and cement a steel patch over the hole. Don't start the engine until it dries. The repair may extend muffler life a year or more.

Mirror Guides You In. If you must angle into a narrow garage, install an old mirror on the back wall of the garage so that you can watch the right side of the car. A dark board mounted outside a window pane will often substitute for the mirror.



Magnetized Keepers Stay Put. A Detroit mechanic has figured out an easy way to beat the usual grease-packing method of installing valve-keepers on an L-head engine. When he takes the engine down he puts the keepers in a box with a strong magnet. When it's time for reassembly, they have enough magnetism to cling to the stem.

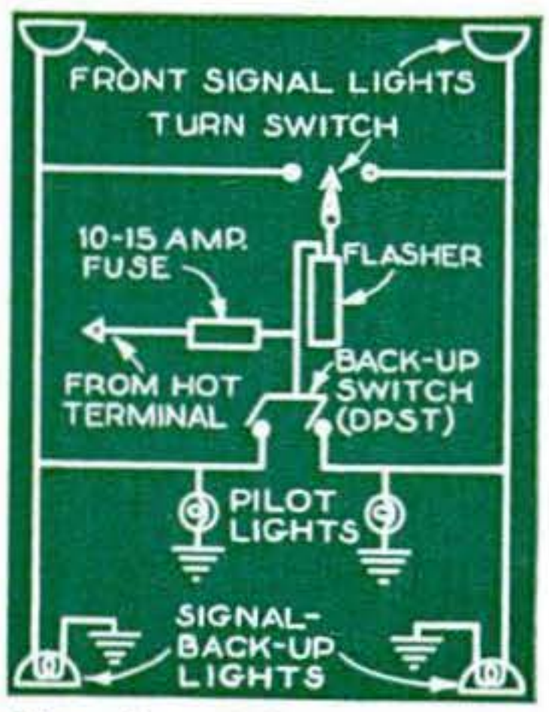


Never Oil Solenoid Plunger. The plunger (arrow) of a solenoid mounted on a cranking motor may look as if it needs oil occasionally—but don't apply it. Oil there will promote gum formation and cold-weather sticking. Apply a little engine oil, however, to the solenoid linkage joints, as above, every 1,000 miles or so.

As large as fog lights, these new signal lamps are visible 100 feet or more behind your car even in the brightest sunlight. At night, you can use them as powerful back-up lights.

Turn Signals Double as Back-Up Lights

By Walter E. Burton



Simple wiring permits rear lamps to work as signals or back-up lights. The pilot lights operate singly to indicate right or left turn, together when the back-up switch is closed.

New jumbo-size lamps blink a brighter warning to drivers behind you. Here's how you can fit the system to your car.

These are parts required if your car already is equipped with a set of conventional directional signals. In that case, the main job is substituting these big lights at rear and putting in back-up switch.

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POWERFUL enough to command attention in the brightest sunlight, these turn signals become excellent back-up lights at night at the flick of a switch. The heart of the system is a pair of large, amber-lensed lamps originally designed for trucks and only recently marketed for passenger cars.

You can install the system from scratch, or substitute the lamps for existing turn signals if you feel your present ones aren't conspicuous enough.

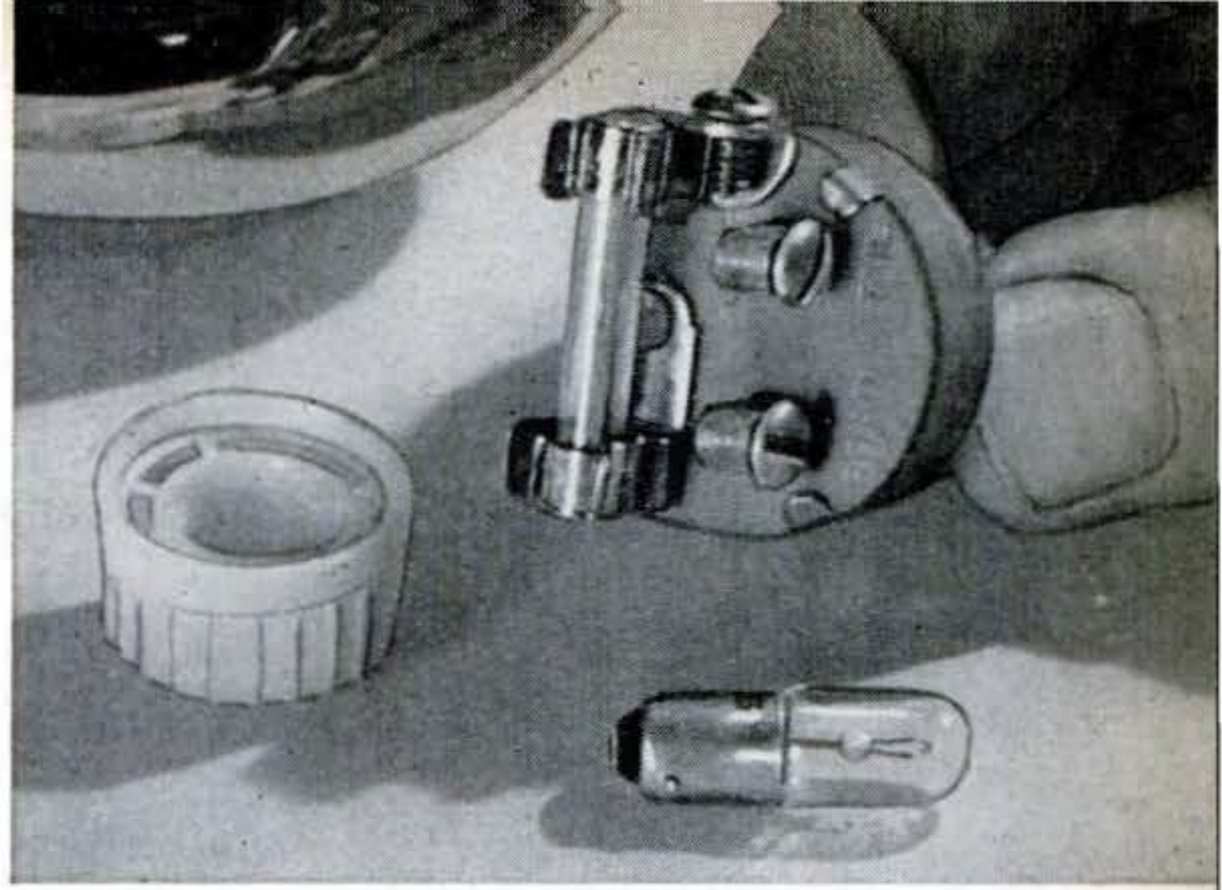
Here's what you'll need if you start from scratch:

- Two "Class A, Type 1" turn-signal lamps for the rear of the car. These are made by many manufacturers and can be had in either sealed-reflector or separate-reflector form. A typical sealed-reflector unit has a 4½" amber lens and corresponds to a 21-candlepower bulb.
- Suitable housings for the lamps. The sealed-reflector unit mentioned fits nicely in a housing for a common fog lamp.
- A flasher unit.
- A steering-column turn-signal switch.
- A standard double-pole, single-throw switch for dash or under-dash mounting. If possible, get a fog-light switch with a built-in pilot light and attached 10-15-ampere fuse.
- Two 6-volt pilot lamps of one or two candlepower and suitable mounts.
- A quantity of 14- or 16-gauge flexible hook-up wire. This should have all-weather insulation for use under the car.
- A pair of conventional turn-signal lights for the front of the car. As an alternative, you can convert the parking lights by installing double-contact sockets and double-filament bulbs of 21-3 candlepower. One filament will then give 21 candlepower for signaling, the other 3 for parking.

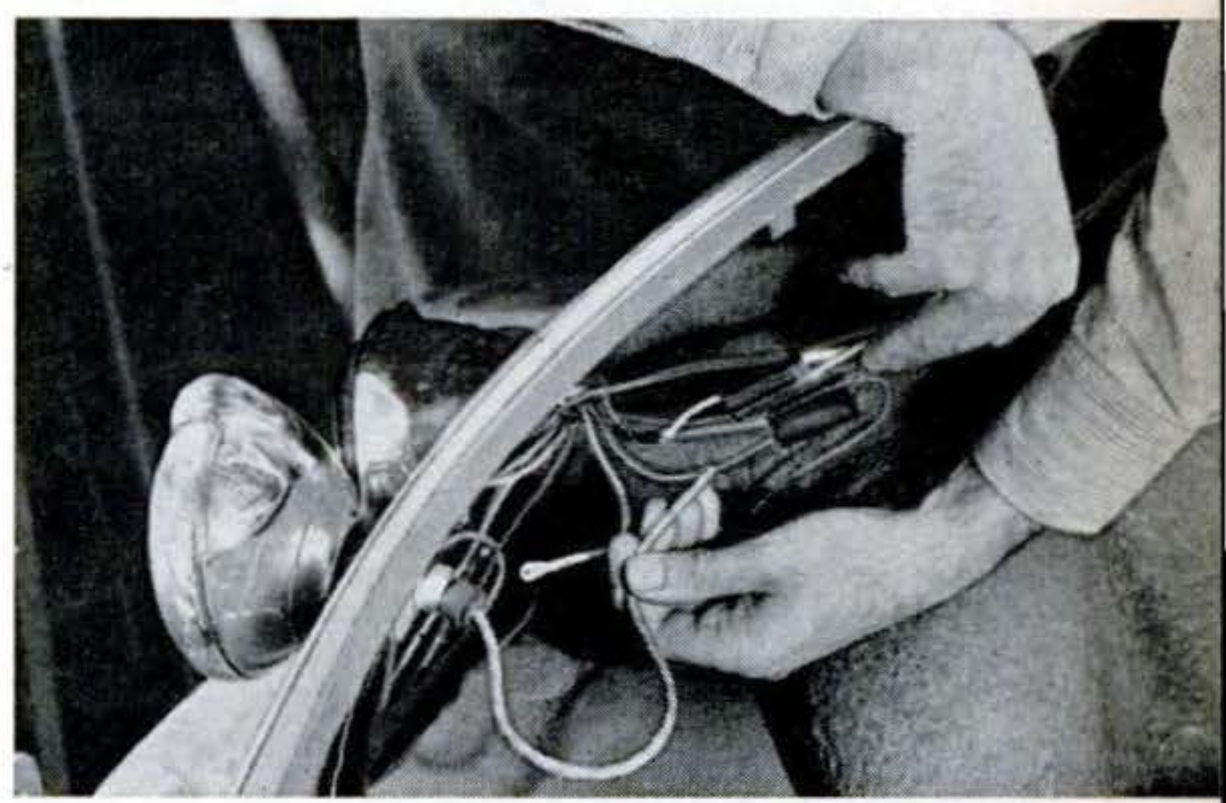
Most of these parts are included in turn-signal kits, although you usually will have to substitute Class A lamps for the rear units provided.

Installing the system. Mount the rear lamps as far apart as possible, not less than three feet, and high enough for easy visibility. Adjust them so that the beams point straight to the rear.

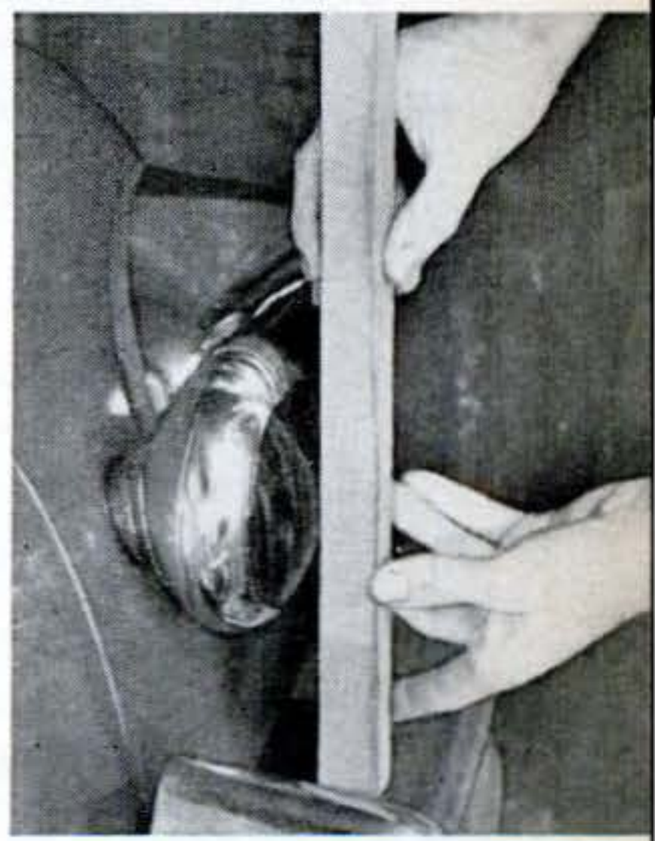
Wire the system so it will be cut off when the ignition switch is off. While you can install a switch to turn on the back-up lights automatically when you shift into reverse, this has to be a double-pole type, and it isn't easy to mount. A manual switch serves just as well.



A two-pole fog-light switch can be used to operate back-up lamps. This one has an attached fuse and a pilot light. Latter goes inside the knob. You can mount switch under the dash.



Lamp was mounted in this case by drilling a ½" hole through car body for a bolt. It might also be placed on bumper bracket. Here, lamp wiring is shown being connected.



A straight stick held vertically is helpful in aligning lamp unit. Stick should be equally distant from top and bottom of lamp rim. Be sure wire is protected from shorts.

Replacing existing lights. If your car already has turn-signal equipment, you will need only the two rear lamp units, a back-up switch, some wire, and a bit of luck in untangling the original wiring system.

Basically, you must disconnect the two wires running from the turn switch to the original rear signal lamps and replace them with wires from the switch to the new lamps. Your car wiring diagram should straighten out any difficulties. END

NEXT MONTH: How to install a spotlight and fog lights in a car.

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Check Your Car Before You Tour

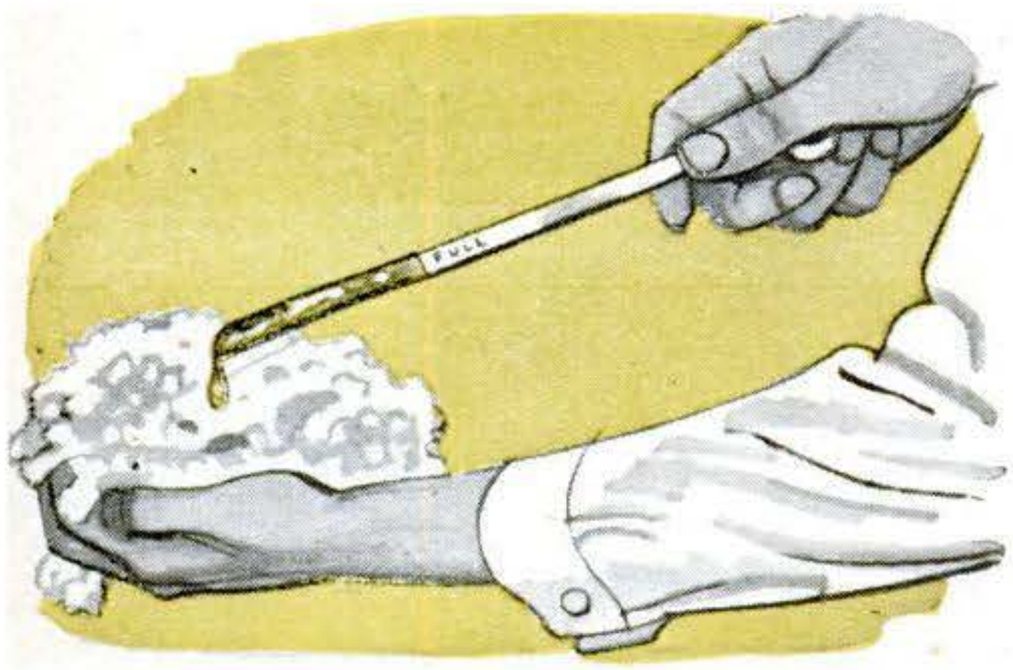
You don't have to be an expert to take these wise precautions.

☐ **Wire-brush corrosion** from the battery terminals, wash with baking soda and water, rinse, and apply petroleum jelly. Check cells with hydrometer. Charge if low.

☐ **Radiator hose** wears out on the inside. Pinch top and bottom hose connections. If they feel spongy, you need new ones. Check the clamps for tightness.

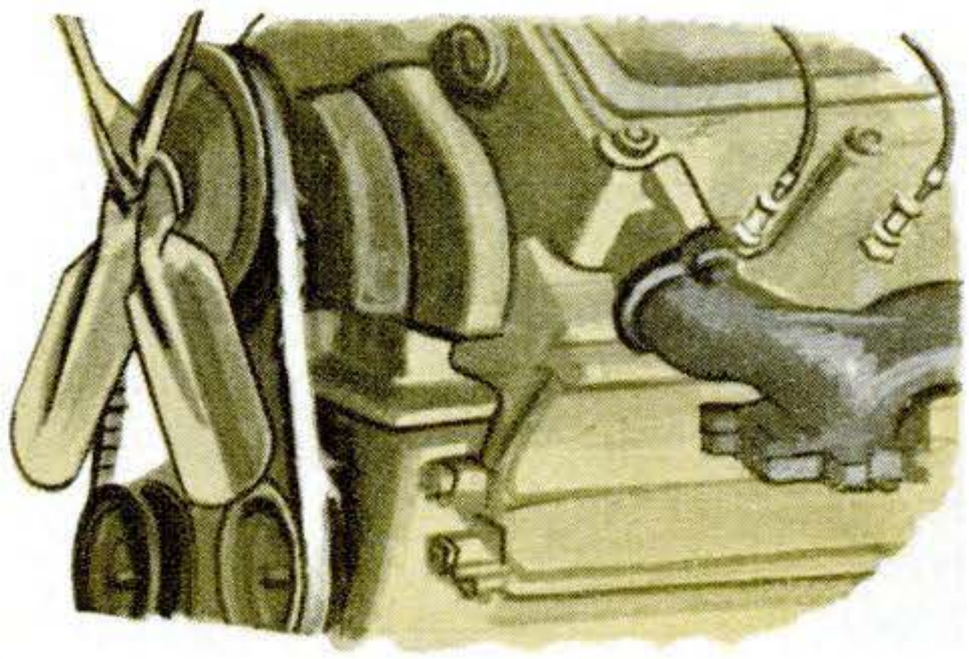
☐ **Spare tire.** Is it in good condition and properly inflated?

☐ **Spark plugs.** Scraping carbon from the electrodes will make a world of difference. Replace any plugs that are cracked.



☐ **Clean the cleaners**—the carburetor air cleaner, the breather cap and vent-pipe filter (if you have one), and the fuel-pump sediment bowl and strainer.

☐ **Brakes.** Are they aligned? Does one tend to grab when they are applied?



☐ **Is your oil heavy** enough for prolonged driving in hot weather? It may pay you to switch to heavier grade than you normally use. Carry extra can in trunk.

☐ **A frayed fan belt** may give way while you are miles from help. Replace it before you start. Also lubricate fan bearings.

☐ **Tools.** Jack, lug wrench, and screwdriver are the absolute minimum requirements. A hammer, tire pump, tire irons, tube repair kit, pliers, spare fuses, and a flashlight are good insurance.

☐ **Front wheels.** Are they aligned? If not, the tires will wear away rapidly.

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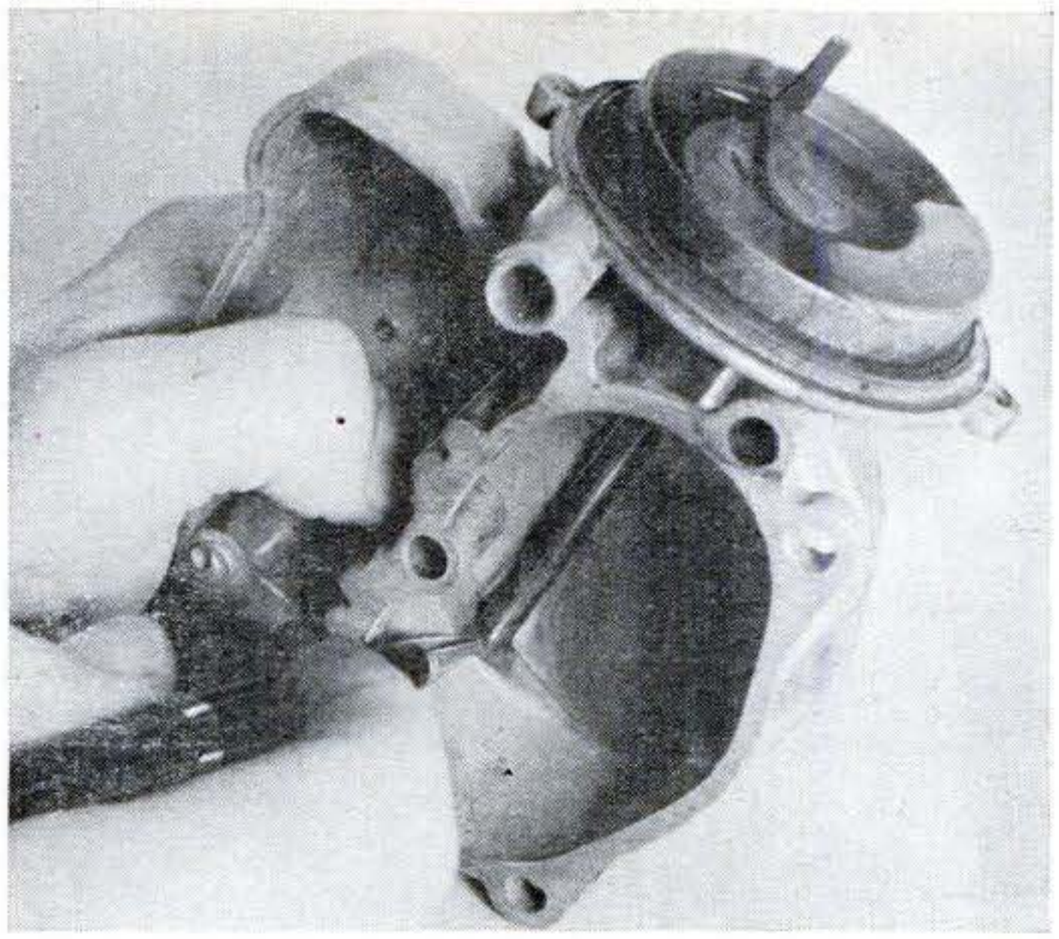
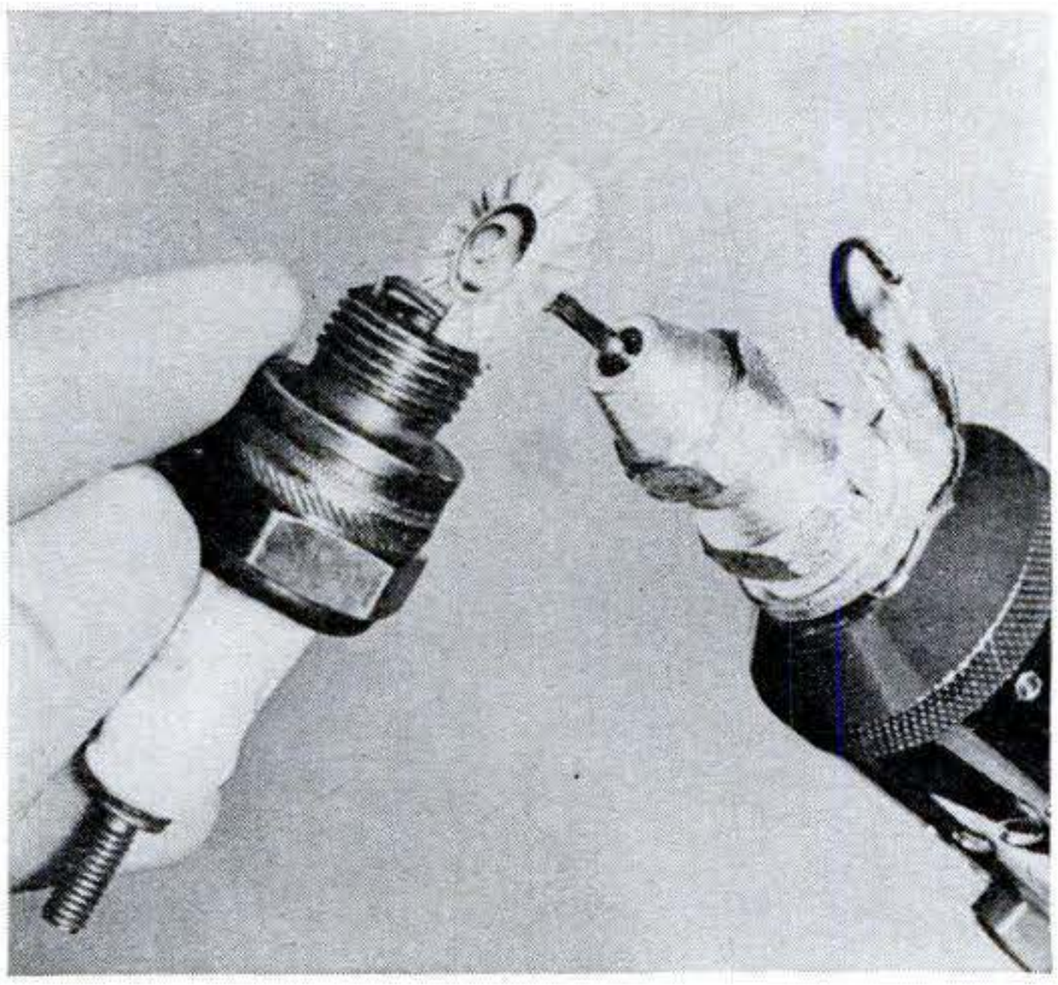


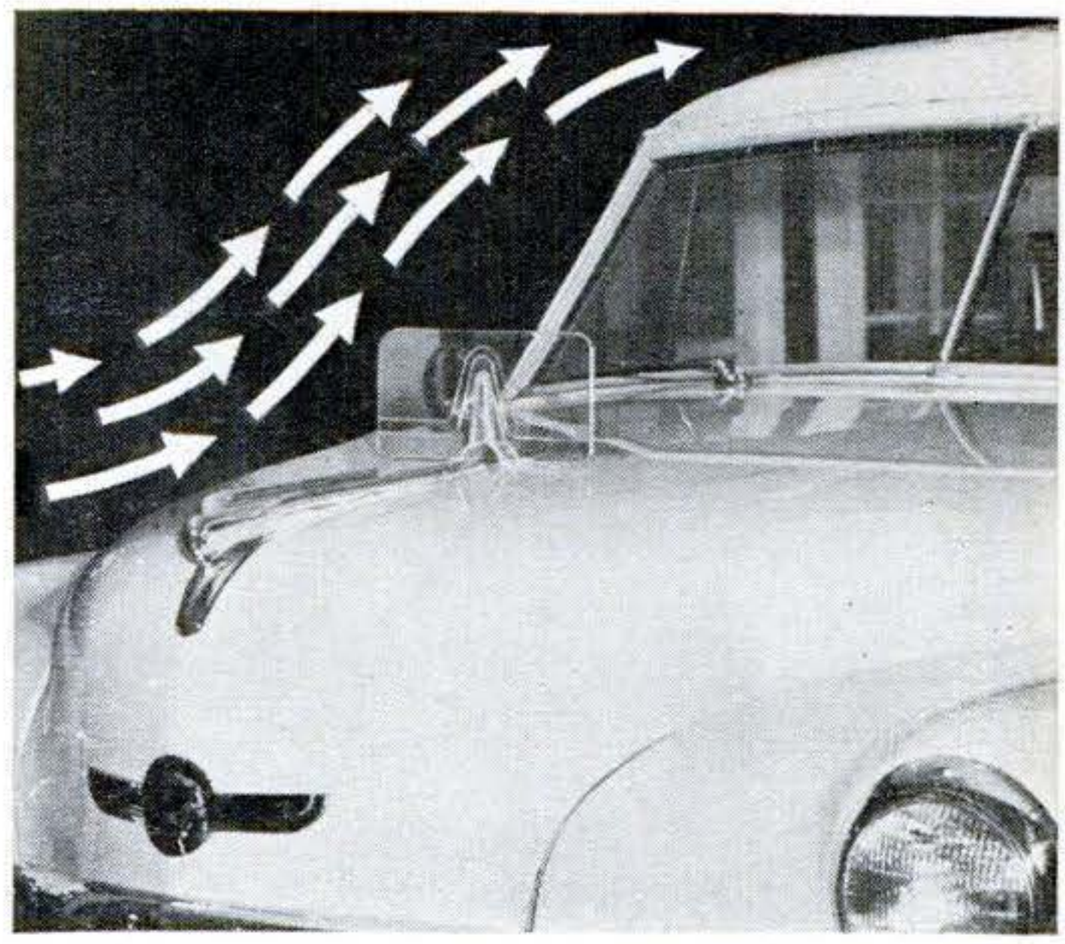
Worn Shafts Let Dirt into Engine

WHEN you take a carburetor apart, check the choke and throttle shafts for wear. The choke shaft indicated by the pencil above was so worn that abrasive dirt was sucked into the engine. Such wear can cause rough idling and make accurate setting impossible. A new carburetor is the best remedy.—*E. F. Lindsley, North Prairie, Wis.*



Women Will Like This Auto Mirror

A SMALL mirror attached to the back of the sun visor on the passenger's side of your car will be appreciated by the women of your family. Perhaps you have a large broken one from which you can cut a small rectangular piece. Attach it with tape.



Deflector Keeps Bugs Off Windshield

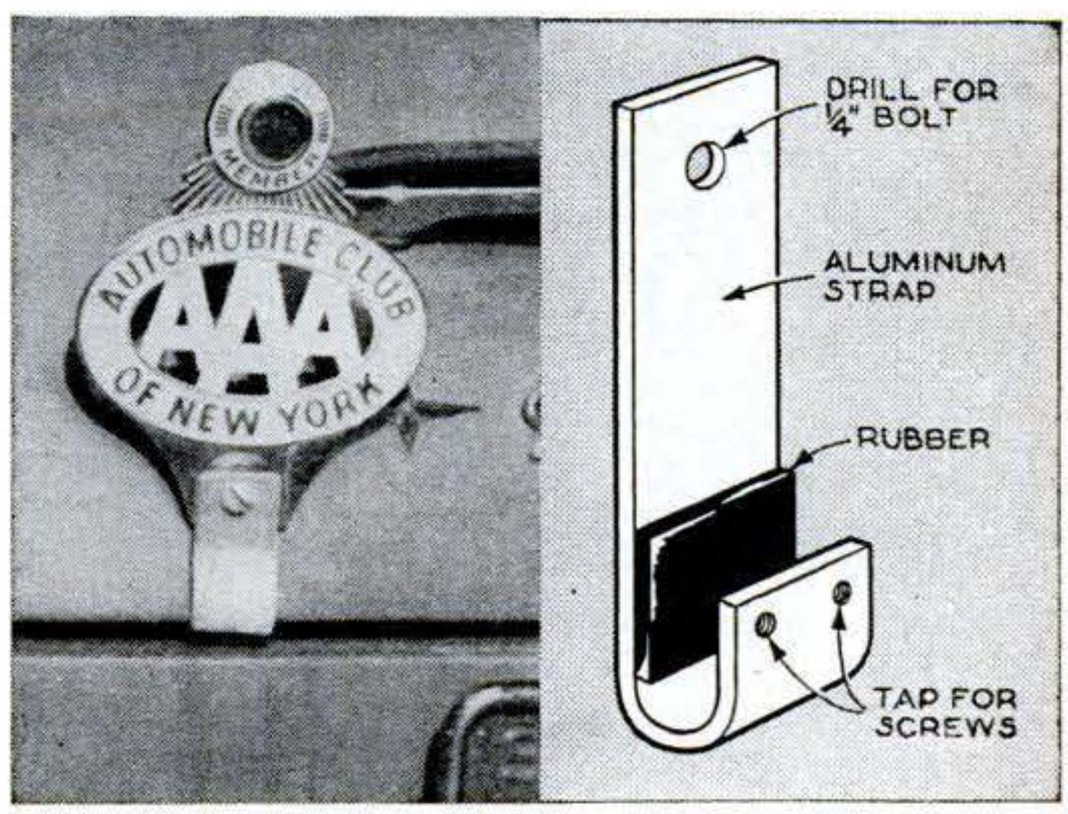
THE air-stream deflector pictured above is designed to sweep insects and dust above a car, and thus keep the windshield clear. Made of plastic in a choice of three colors by Lessco, Inc., of Franklin, Pa., it snaps on the hood ornament or center hood molding. On cars that do not have such trimmings, it can be mounted on the hood with screws.

Hand Grinder Cleans Spark Plugs

CHUCKING a circular brush or polishing wheel in a hand power tool as shown at the left makes it easy to clean spark-plug points. Grinding disks will clean up burned places, but take care not to overdo the job.—*H. Leeper, Canton, Ohio.*

Aluminum Bracket Holds Club Emblem

BRACKETED to the bottom edge of my car's trunk lid, my club emblem now rises with the lid—and doesn't get in the way as it used to when attached to the license bracket. Setscrews in the bracket bear against the inner edge of the lid. A square of inner-tubing protects the paint.—*Harrison Neustadt, New York City.*



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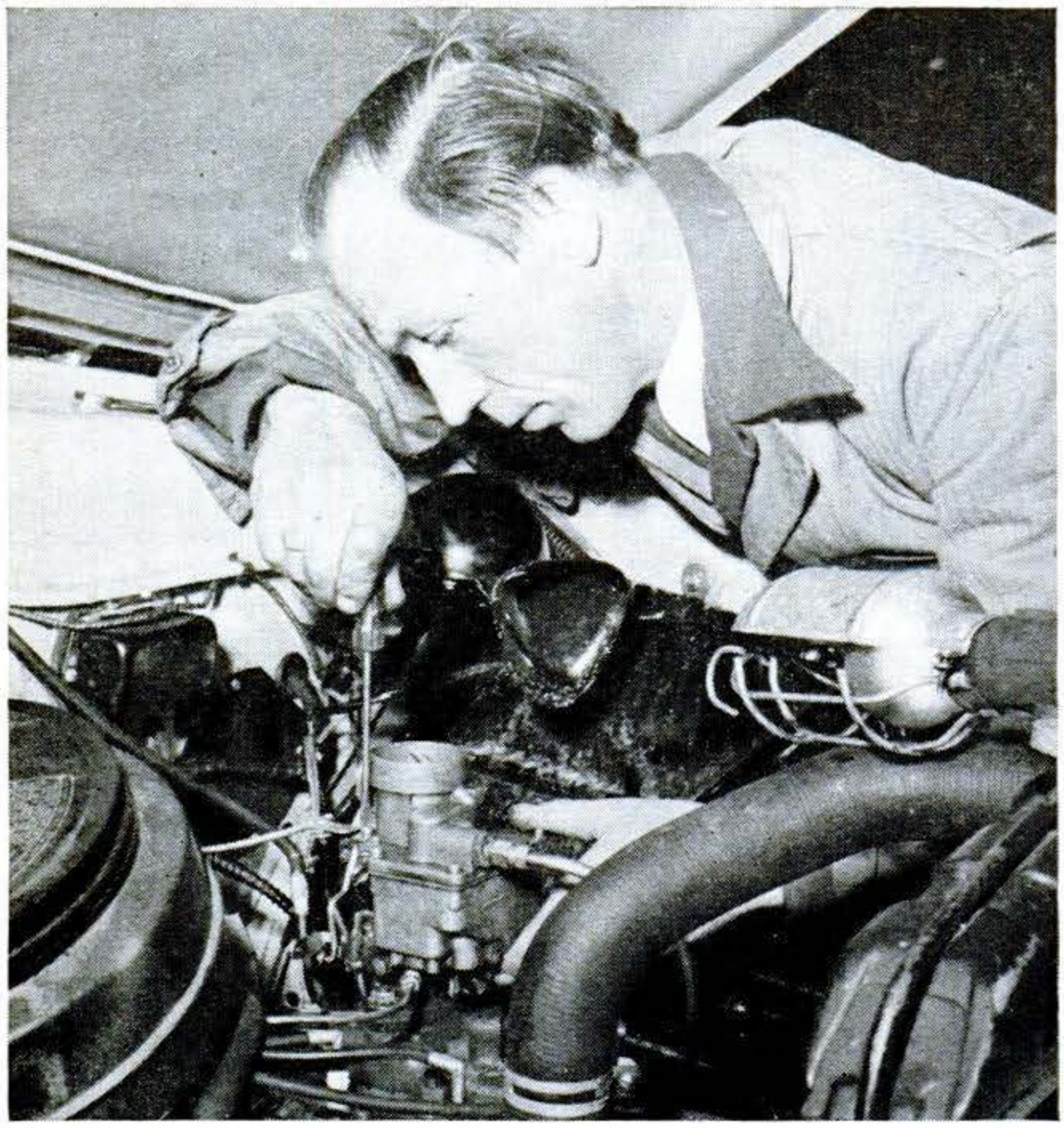
How I Save Gas



Carburetor was set slightly lean on the winning car as best compromise for wide range of driving conditions encountered on the run. AAA observers sealed engine at 37 points to prevent alteration of stock status of car.

Soft tires lower gas mileage. So competing drivers were careful to keep them inflated. Rules allowed two pounds above normal.

Wheel balance is another factor in gas economy. Lead weights were put on wheels of competing cars, a good practice for all motorists.

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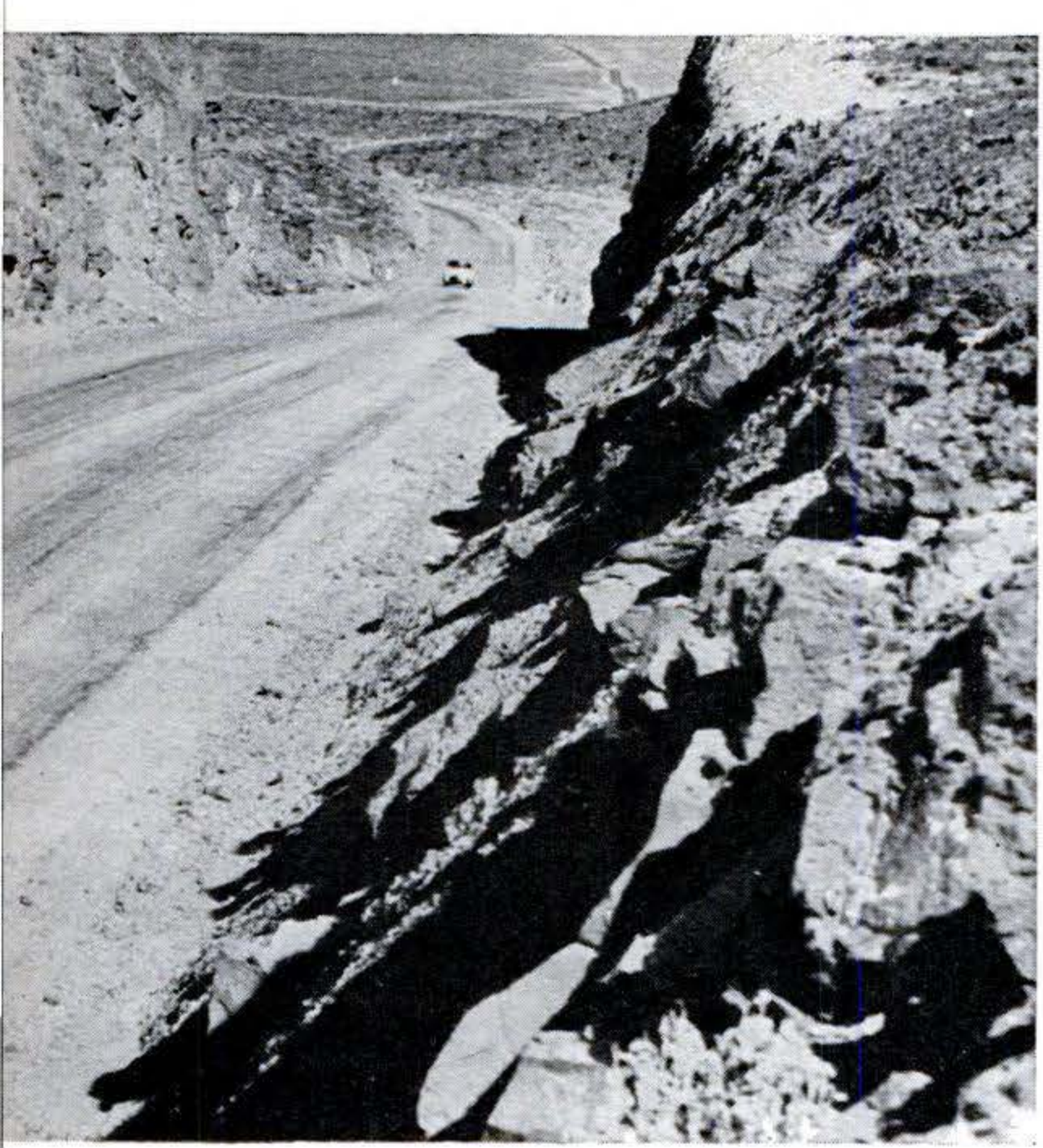

Facts About the Economy Run

LES VILAND, who answers Gus Wilson's questions below, won the Sweepstakes Trophy in this year's Mobilgas Economy Run. The 840-mile course from Los Angeles to the Grand Canyon included 70 miles of city driving, 345 miles of mountain roads, and 425 on the level.

Winners were determined by a ton-mile formula that puts all cars on an equal footing. Viland's actual average of 25.448 miles per gallon was bettered by five class winners—a six-cylinder Nash Rambler, 31.053; four-cylinder Henry J, 30.109; Studebaker Commander, 28.001; Ford Eight, 25.994; and Mercury, 25.945. But Viland's score by the formula, 66.484 *ton*-miles per gallon, made him the grand champion gasoline-conserver.

Winning car driven by Les Viland (inset) hit a good clip up the Argus Mountains in eastern California on first day of the two-day run.

. . . . By This Year's Stingiest Driver

Les Viland tells how he coaxed more miles out of each gallon to win the country's major economy race.

Dear Gus Wilson:

Here are answers to your questions about how I won this year's stock-car Mobilgas Economy Run by averaging 25.448 miles a gallon with a Lincoln sedan. Every good citizen should get all he can out of his gas nowadays, and I hope these tips will help your readers go farther with less.

The car I drove was strictly stock. No souping up or mechanical changes were permitted. It had a handshift and overdrive.

We usually think of gas in terms of gallons, but I saved it in drops --and believe me the drops add up.

How was the carburetor adjusted? An engine operates differently in dense and rare atmospheres, in desert heat and mountain cold. The route of the Economy Run passes through Death Valley 280 feet below sea level and across mountains 7,300 feet high. The average altitude is about 3,500 feet. So we allowed one step lean on the carburetor jets. The slightly lean setting gave me a fair average for the whole run. Spark plugs, timing, and other vital parts were set according to the factory manual.

How did I start the engine? The Lincoln has an automatic choke. The carburetor was adjusted so the engine would idle smoothly at 375 r.p.m. when cold. Clutch in, car in low gear, I turned the key, touched the starter button, let the clutch out, and was rolling within one-half second.

Does the manufacturer approve of this? Not exactly. Most operators' manuals advise you to let a cold engine idle until the water is warm --100° or so. Point is, avoid loading the motor until lubricating oil is thoroughly distributed. I started slowly, with a "soft" throttle.

How did I upshift? Normally I go into second at five miles an hour, into high at 15, into overdrive around 30. During the run I started shifting out of low as soon as the car was moving . . . second at three, high at five. Upshift at the

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Gassing up. An inspector doled out fuel drop by drop with a syringe and graduate at a service stop. In the run, all cars were leveled and filled to an exact specification before the gas tank was sealed. Before his tank was sealed, one contestant taped the gas-cap chain as below to keep it from marring the paint. Viland did not fill his tank full because the extra weight would have reduced his gas mileage.

slowest speed you can without making the engine work too hard in the higher gear. The slower the engine turns in relation to the car's speed, the less gas is consumed.

Metering during test runs gave me the answer: quick shifting saved four thimbles of gas on each start. On 15 starts from traffic lights and official check points, I saved 60 thimbles, or 1/30 gallon.

Ever upshift directly from low to high? Under some conditions on a level road with the engine warm. When a cold engine is accelerated quickly, the pistons tend to scuff the cylinder walls because the oil is not warm and flowing. Often during the run I shifted directly from first to high at five miles an hour to keep down the engine r.p.m. It's an acceptable practice when done with restraint and when a too-heavy throttle doesn't cause the engine to lug.

Hit a stoplight while it's green? Always, when traffic permits. From four to nine times more gas flows when you start from a standstill. I went through all but one of 32 Los Angeles traffic signals in high. To avoid that single red light, I would have had to go faster than the law permits, or slow into low gear. It was better to stop 30 seconds, and cut the engine.

Normal speed on the open road? Most economical speed for the average car falls somewhere between 30 and 35 miles an hour. The first day we had to cover 541 miles in 13½ hours for a 40-mile average. Slowdowns caused by traffic and signal stops meant I had to average 45 when moving. I studied my special map carefully, and actually averaged 40.3. On the 229-mile second leg I averaged 40.6, thanks to some long downgrades. If I could have kept it down to 35, gas mileage would have improved considerably.

Did I speed up to approach a hill? About five miles an hour. The added engine revolutions meant I could keep a more even load on the engine during the upgrade pull. Also, by depressing the throttle gently and maintaining a constant speed, I could avoid using the carburetor's power jet. By not going beyond nine-tenths full throttle I prevented that extra waste of fuel.

When to downshift? The feel of your motor is your best guide. But I did not follow this rule. I shifted arbitrarily to second, keeping the throttle well open, whenever the speedometer dropped to 25. This procedure enabled me to build up enough speed so I could upshift quickly to gas-saving high gear. Driving wide open in second is wasteful of gas, but in this case temporary waste paid dividends.

What about automatic transmissions? While these very properly shift down without the driver's help when the pull gets a little tough, that very

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fact keeps them out of the Economy Run. We relied upon rules-of-thumb for shifting, both up and down.

Faster downgrade? Naturally, but always in gear--that's one of the AAA rules governing the run. On quite steep hills, I let her out to 55, and occasionally 65. (Highway officers permit a slight "courtesy" overspeeding.) Little is gained from coasting in neutral. Idling or pulling more vacuum on the jets by high-speed running against compression makes no appreciable difference in gas consumption.

Did I keep overdrive in operation constantly? Except when descending steep grades. On milder hills I used overdrive for compression braking. It's a good rule to roll against overdrive compression until this ceases to hold the car at a desired speed. Then, instead of using the brakes, shift down to whatever gear may be needed.

What was the effect of altitude on my handling of the car? Remember, I drove one day through 95° heat in Death Valley, 280 feet below sea level, only to climb the next day 7,330 feet above the sea with the thermometer just a few degrees above freezing. One difference is important. Around sea level throttle pressure must be gentle to prevent detonation; on the mountain top sudden full throttle does not force detonation. That's due largely to the change in the engine compression ratio between Death Valley (7:1) and the highest pass (6:1), resulting from the change in atmospheric pressure.

Did gas evaporate in the desert? The percentage of loss in the tank was too small to be counted. Evaporation, accounting for about one percent, was offset by the two-percent increase in volume as it warmed. That's why it pays to fill up in the morning before the sun warms a station's underground tanks.

Weights added to each car raised total passenger weight to 750 pounds so all would be equal in this respect. Each car carried driver, relief driver, mechanic, AAA observer.

Did I fill the tank full? No, but not for the reason you may think. Every pound of weight cut my gas mileage fractionally. I took only enough to reach the next stop, plus four gallons for safety. Too, leaving a little air space kept the precious stuff from sloshing out at corners.

How much air in the tires? I started with 28 pounds in front, 26 in the rear--two pounds above the normal Lincoln recommendation and all the contest rules would allow. Personally, I prefer 32 and 30 for all driving. The higher pressure means less flexing of the walls and a saving of gas. And I never let any pressure out. If it goes up, it's bound to come down. A tire in good condition can easily withstand 100 pounds internal pressure.

What oil weight? In the run I used a very light oil--No. 5. The heavier the oil, the more gas it takes to drive the car. My personal preference for ordinary driving in a new car is to use S.A.E. 10 oil until I need a quart every 700 miles. Only then do I use a heavier grade.

Les Viland, sweepstakes winner,
1951 Mobilgas Economy Run

Viland's Money-Saving Rules

Go easy on the throttle. At 35 m.p.h., gas costs an average of 1.44 cents a mile. At 65, it leaps to 3.86 cents. Pumping the throttle really eats up gas.

Get into high gear quickly. At 20 m.p.h., second eats 15 to 20 percent more gas than high.

Keep off the clutch. Riding it wears out the mechanism—and wastes gas.

Ease up on the getaway. It isn't worth 60 percent more gas to beat the other guy across an intersection.

Pace yourself to avoid red lights. Fewer stops can save a fifth in city driving.

Don't idle. Shut off the engine when you park and save pennies, lots of them.

Spare the choke. If you have an automatic choke, be sure it's properly adjusted. An automatic one on the fritz or a manual one not pushed in throws away fuel.

Tune up regularly. Replace worn parts. Replace distributor points and spark plugs every 10,000 miles. Make sure spark timing agrees with recommendations.

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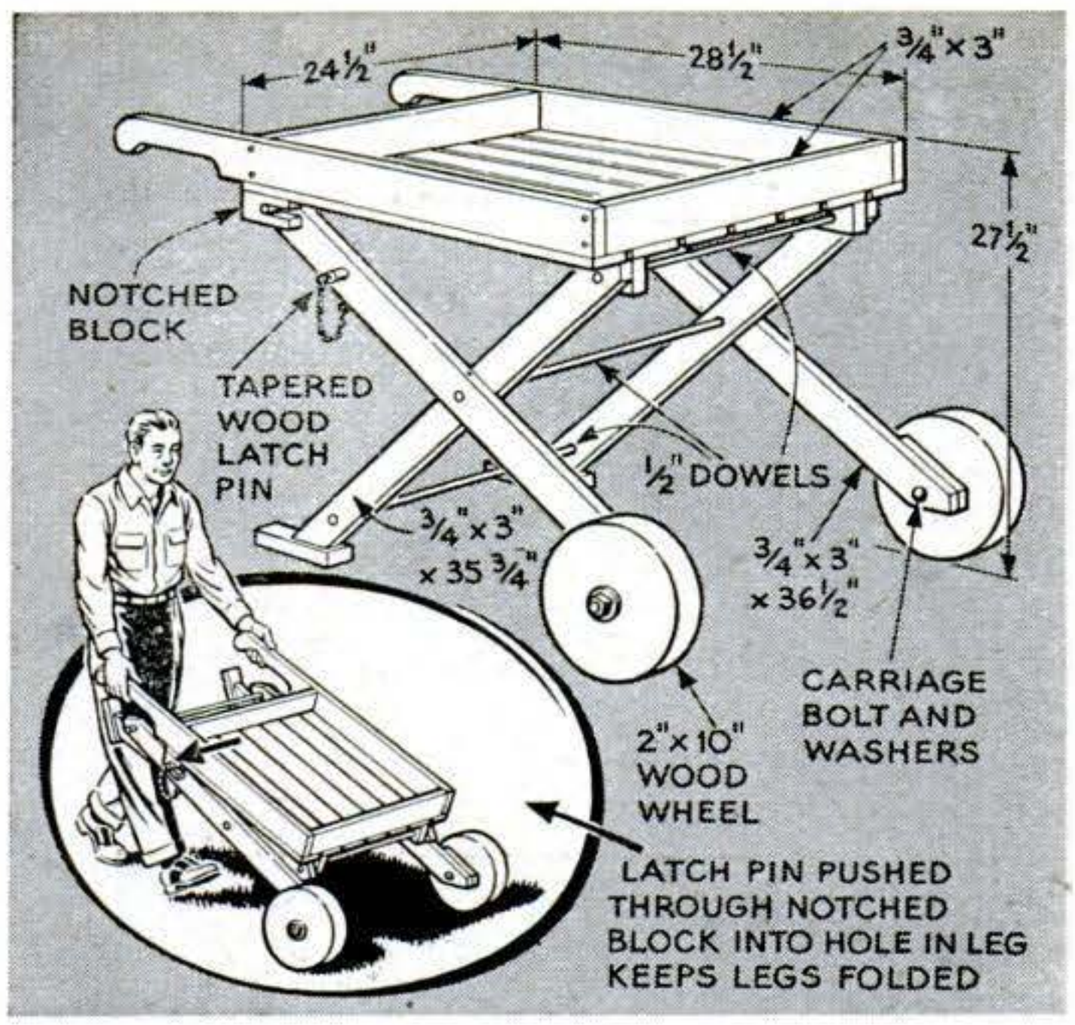
Back-Yard Barbecue Cart Folds Up For Easy Storage in Garage or Shed

HERE'S a homemade serving cart that will make it a lot easier for you to move out to the back-yard fireplace for picnic suppers this summer. You can use it to haul food and equipment back and forth and as a serving table during the meal.

The crossed legs may require a bit of painstaking fitting to make the cart fold up smoothly, but otherwise the construction is simple. For the most part, you can use stock lumber sizes, and simply cut the pieces the required lengths. Space the tray slats slightly apart, or make the tray solid. A pair of scooter wheels can be used if you'd rather not make wooden wheels.

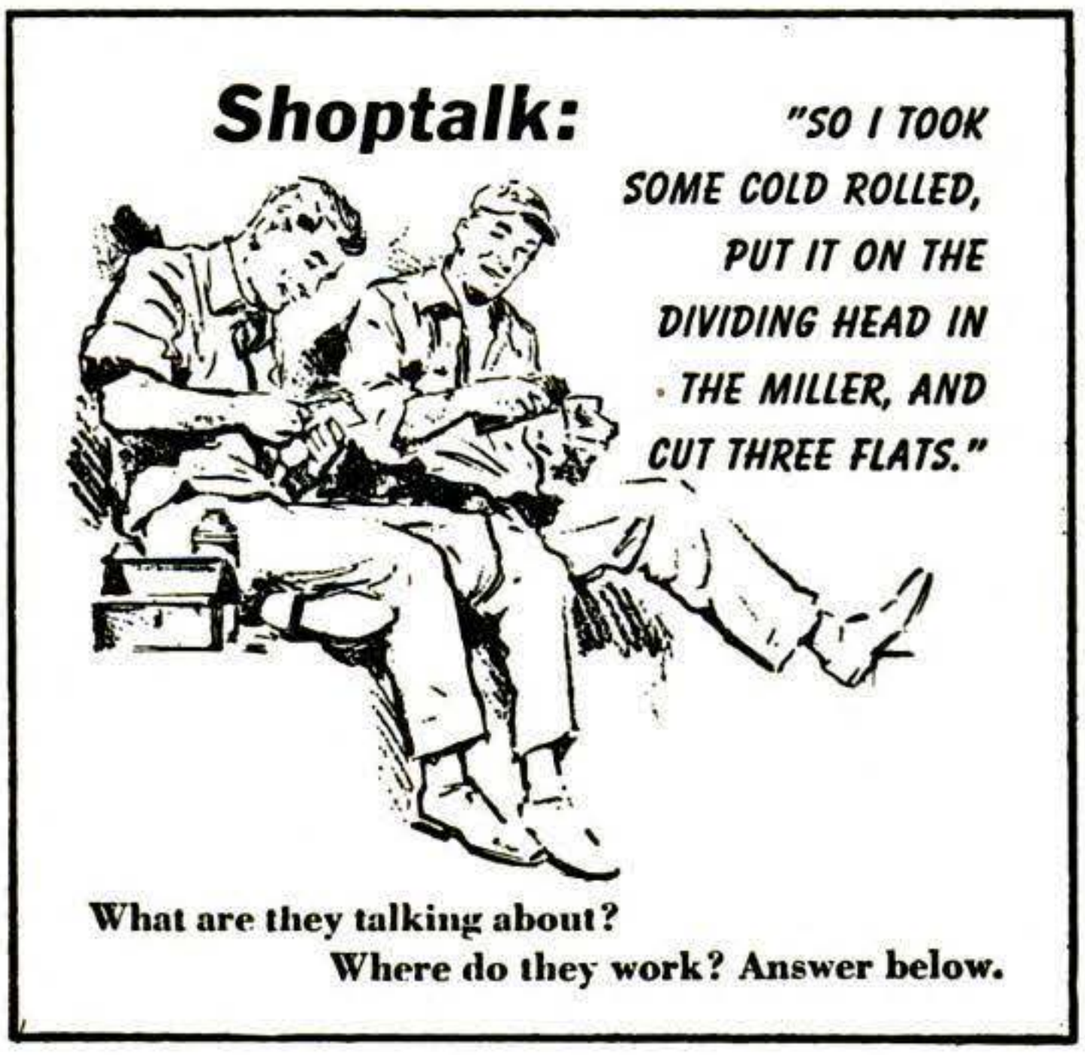


Tray on Drawer Makes Work Table

A TRAY rested on an open drawer provides extra work space in a small kitchen.—*Benj. Nielsen, Aurora, Neb.*

Plywood Ring Handles Hot Coffee

SINCE a cardboard container of hot coffee is often hard to handle, I jigsawed this plywood ring to serve as a grip. Cut the inside diameter of the ring so it comes up about 1" from the top of the cup. Then just slip the container down through the ring.—*H. B. Graeff, Los Angeles.*



They are machinists. A finished shaft with three flat surfaces equally spaced was wanted. A dividing head supports work in a machine and accurately divides a circle into equal parts. Cold rolled is a common type of steel. A miller is a milling machine that shapes and dresses metal surfaces.

Plastic Gun Shoots Smoke Rings

THE rocket-shaped plastic gun below shoots perfect smoke rings. A matchlike chemical smoke pellet, inserted in the ammunition chamber, hits a fixed striker strip when the chamber is closed. A trigger-operated thrust mechanism then releases the smoke in rings. The maker, Nu-Age Products, Beverly Hills, Calif., says the smoke is nontoxic and that there is no danger of fire. A supply of pellets and striker-strip replacements comes with the gun.

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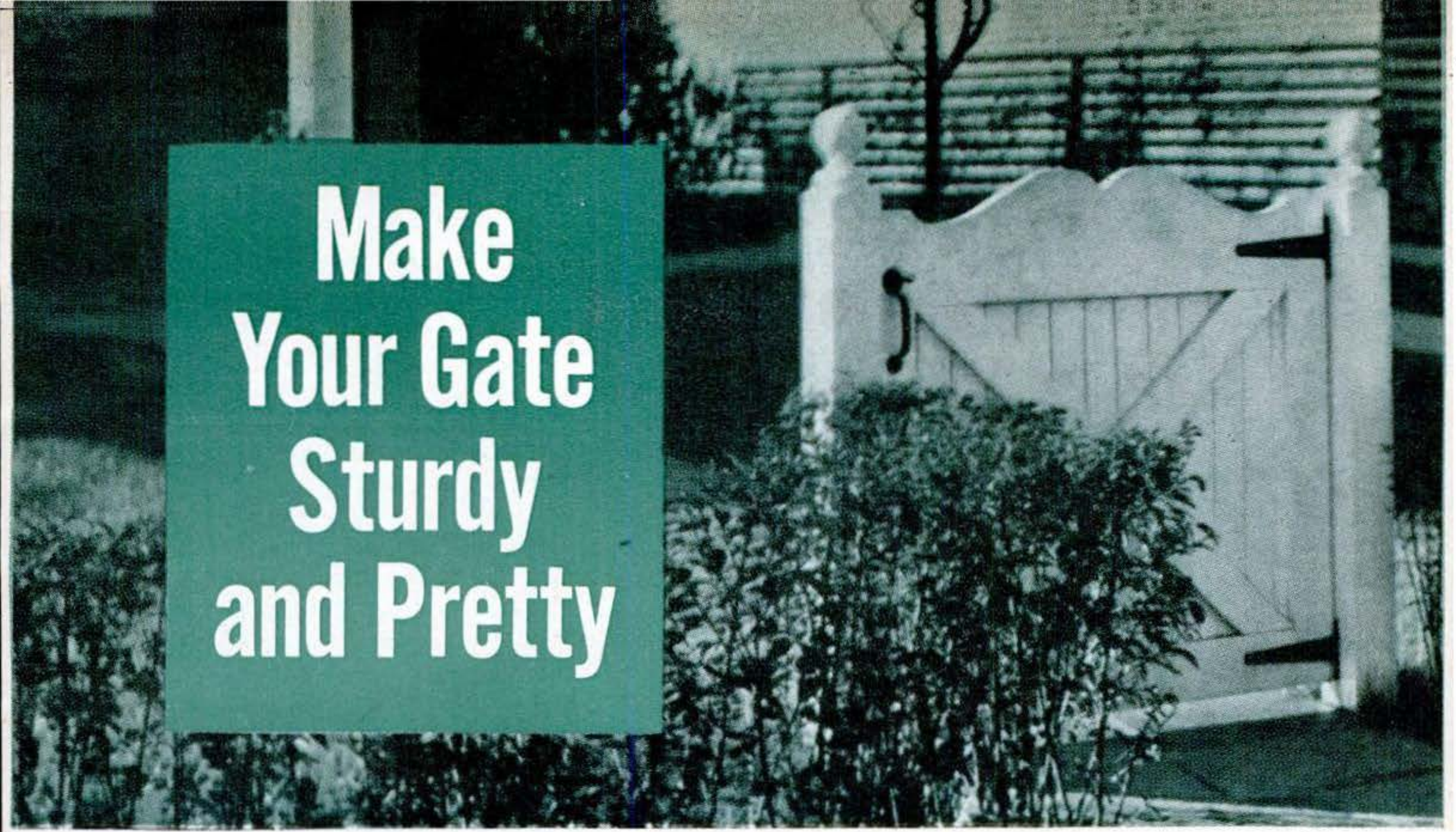
Make Your Gate Sturdy and Pretty



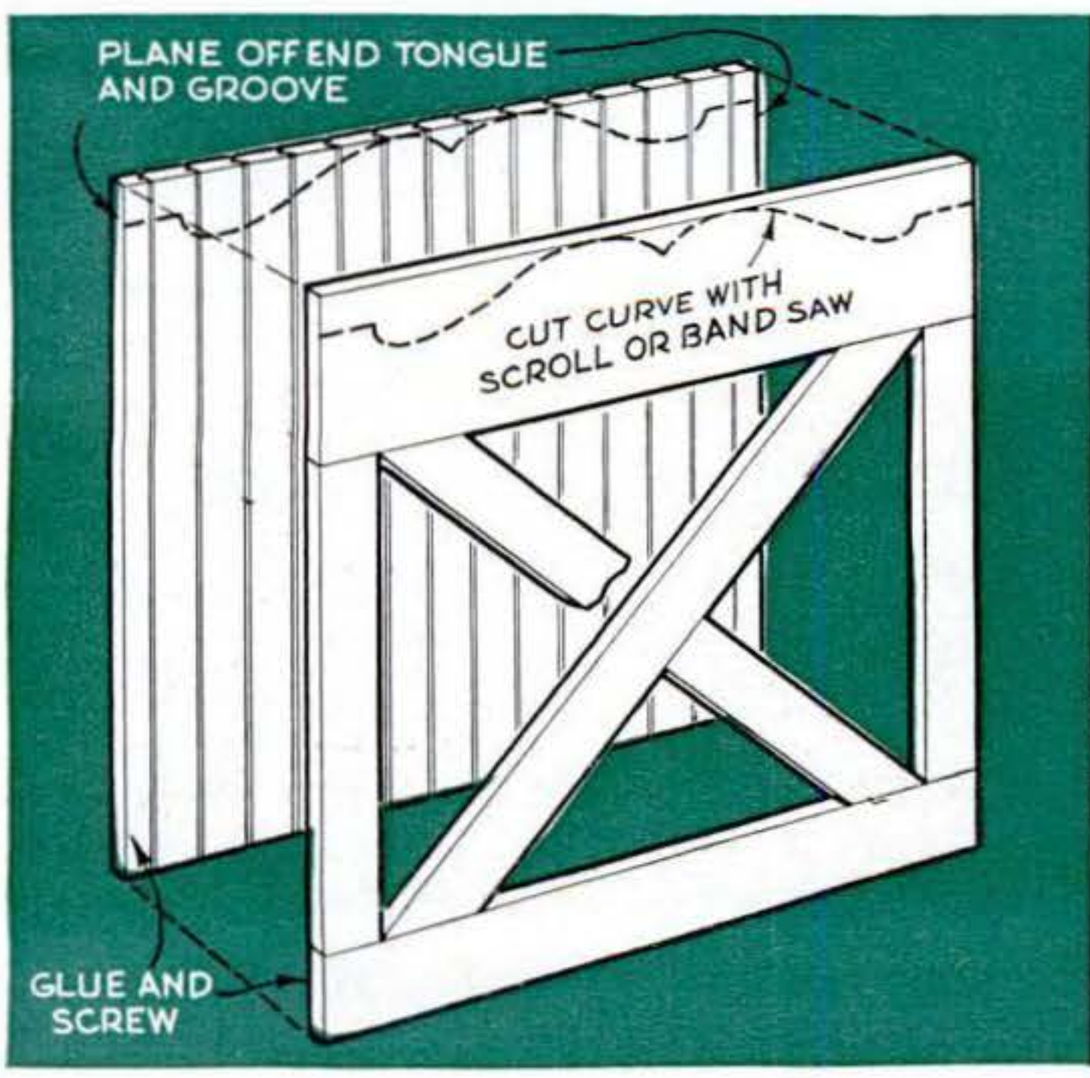
Six handsome hand-tool designs to replace a sprung or droopy gate.

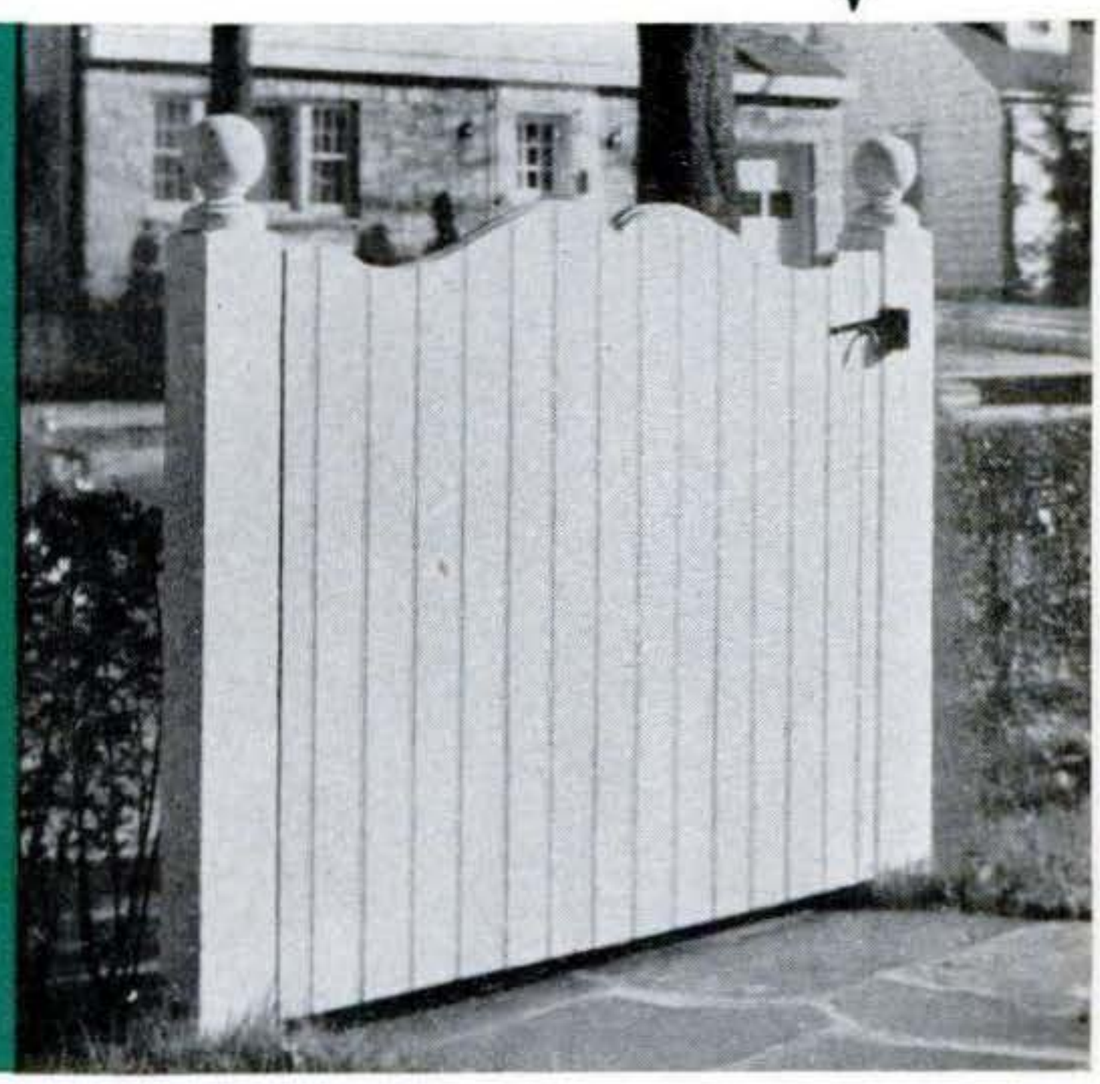
YOUR gate should belong to your house and grounds. It should also be sturdy enough to withstand the weather and the punishment of young cowboys who consider it a pony.

No complicated mortise-and-tenon joints are required in the gates pictured here and on the next two pages. Horizontal rails should be lapped on top of uprights, wherever possible, to keep rain from seeping into end grain, and vertical members that cannot be protected this way should be pointed or tapered so that moisture can drain off.

Paint is your gate's best protection against rot. The most vulnerable parts—and the hardest to protect—are cracks, crevices, and joints. It's often a good idea to paint meeting surfaces on individual parts before assembly. If you join the pieces while the paint is still tacky, some paint will run into the seams and seal them.—*Max Alth, Yonkers, N. Y.*

The front and back of this gate are entirely different, but both are handsome. All joints, including the diagonals, are butted. Front and back are glued and screwed together before scroll is cut in the top.





Turn the page, please, for five more gate designs.

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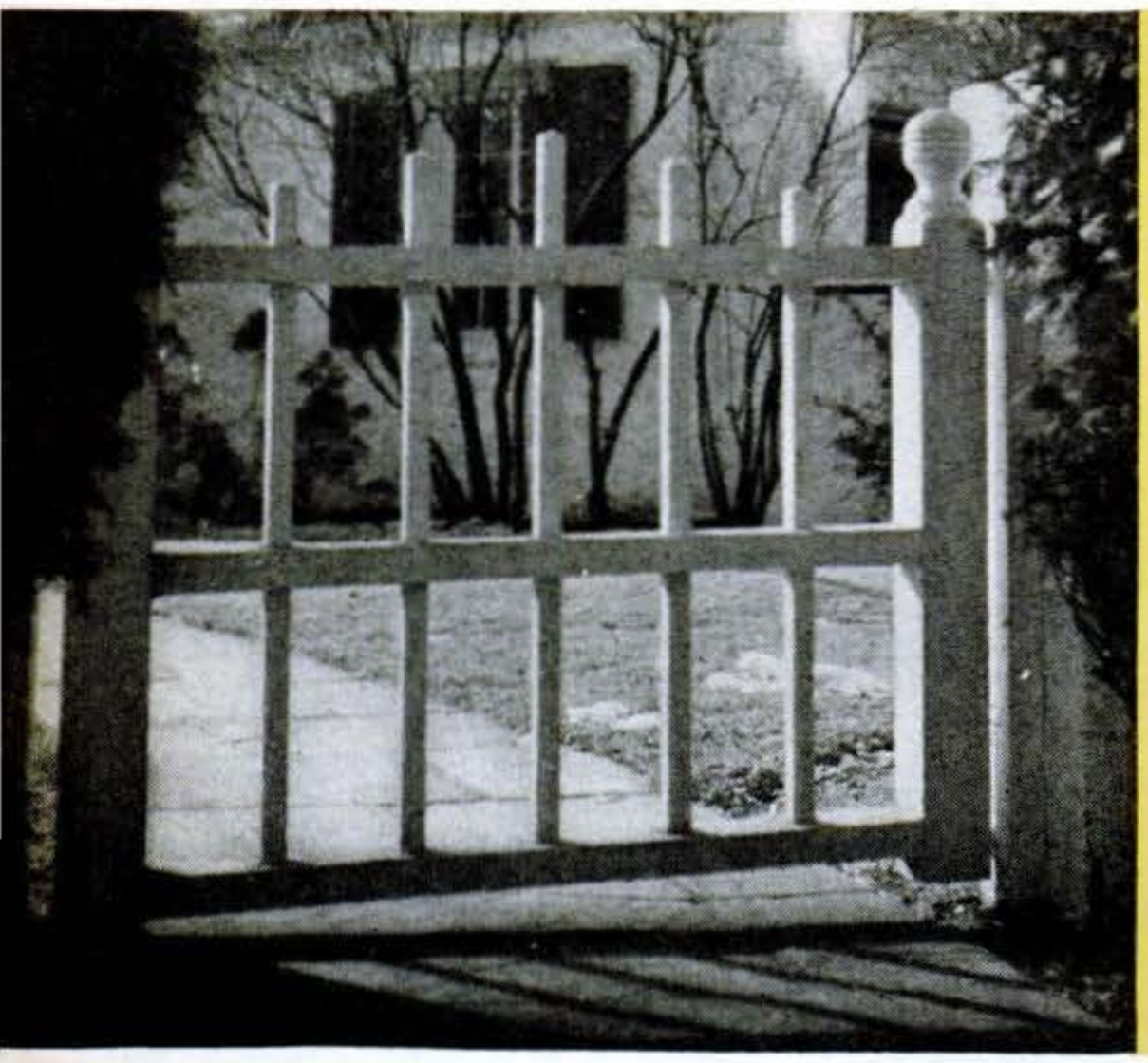
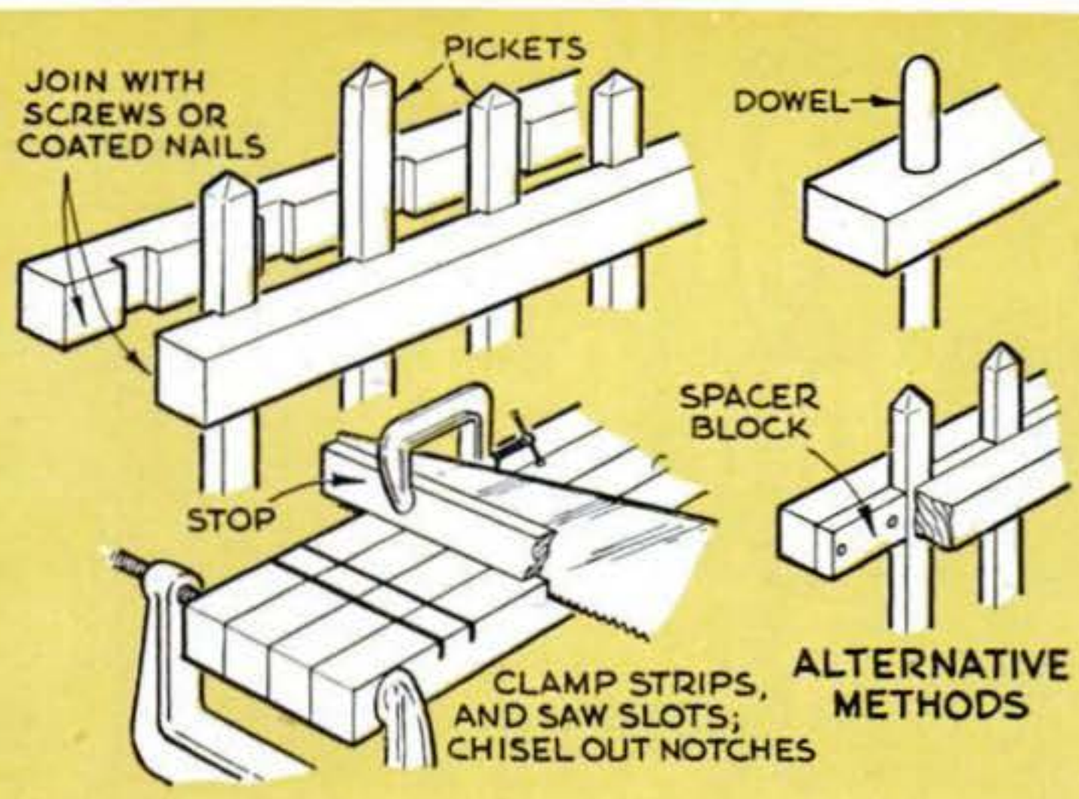
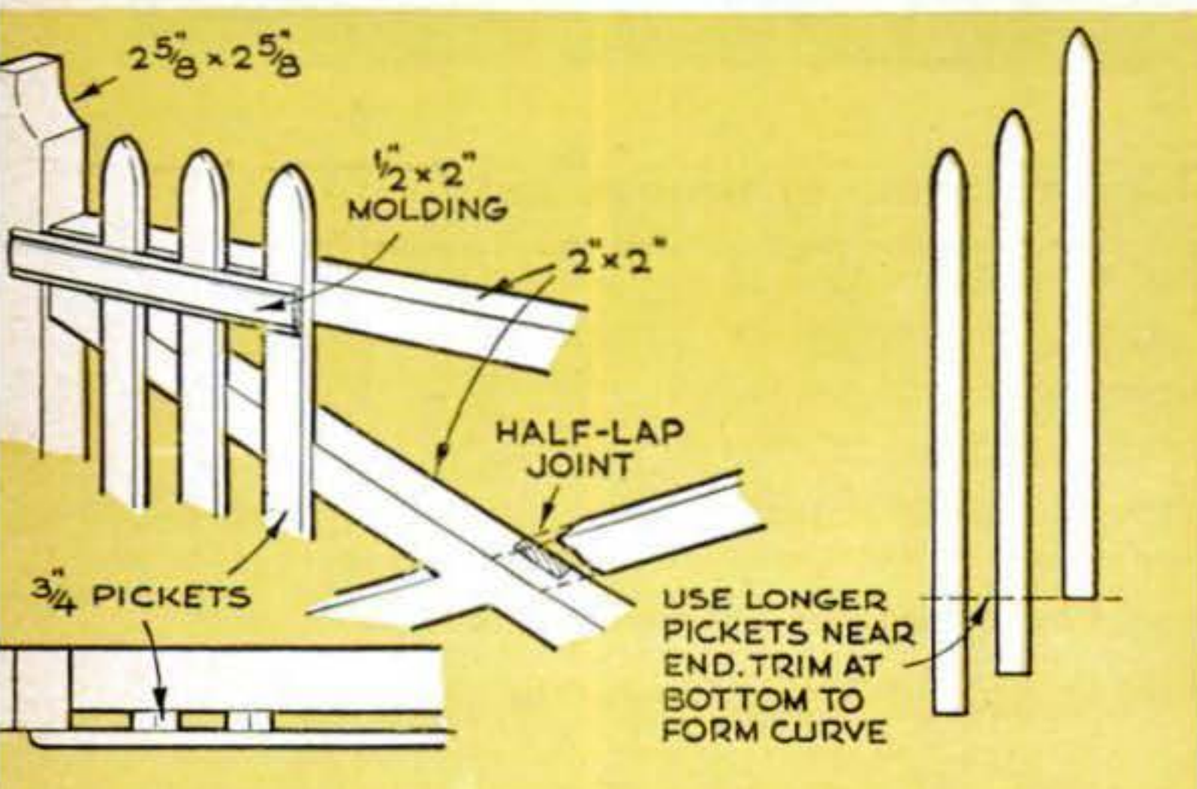
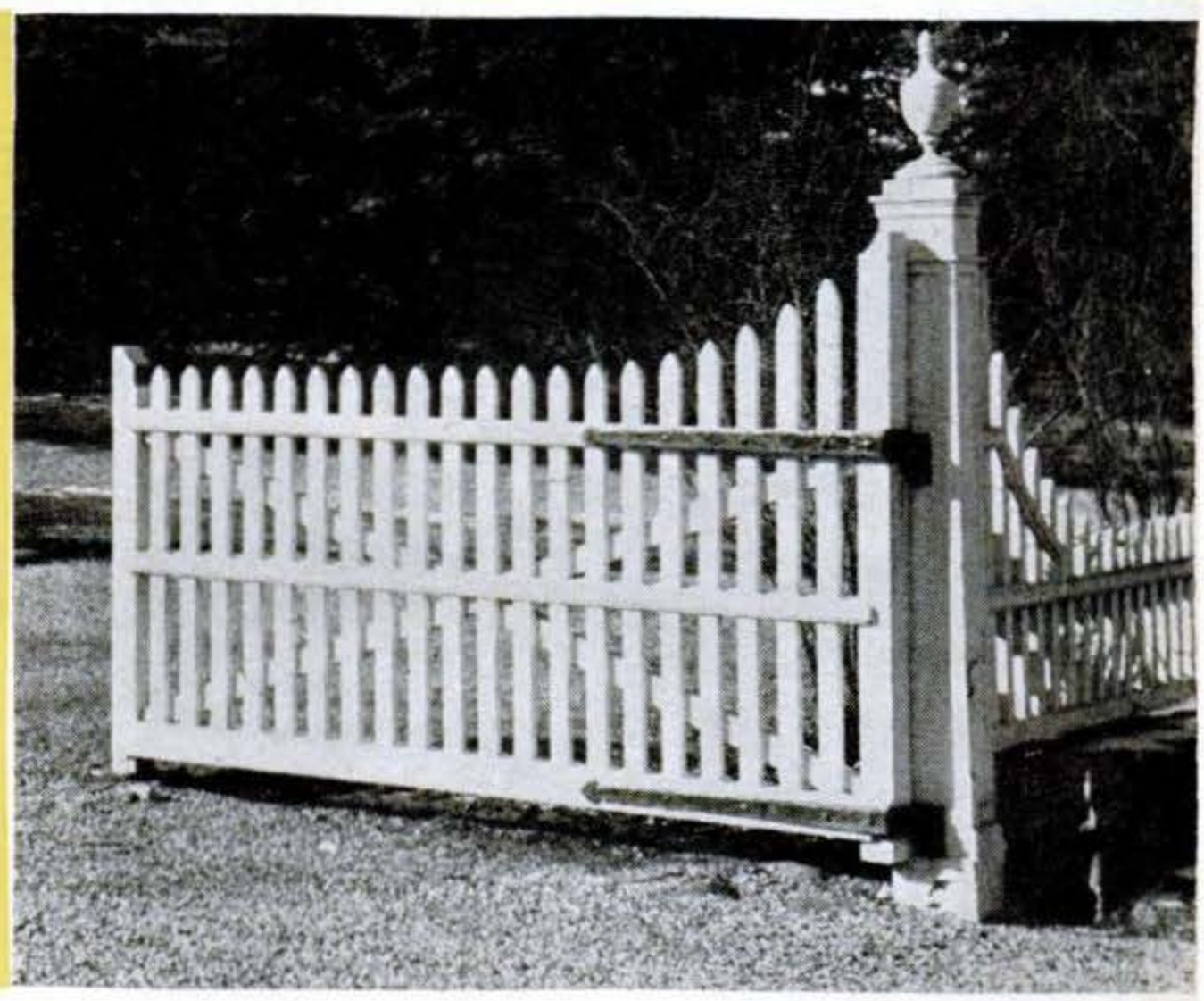


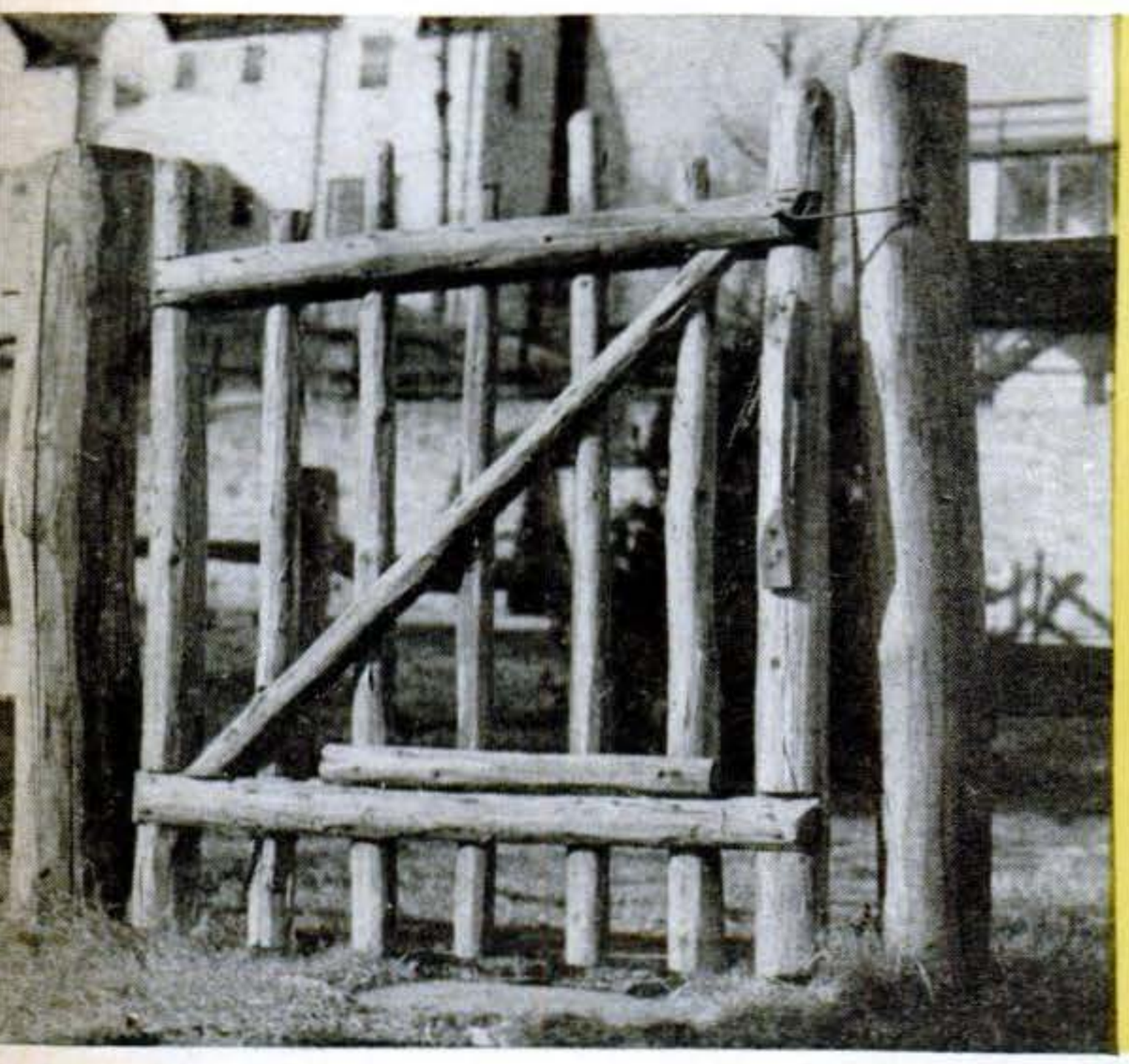


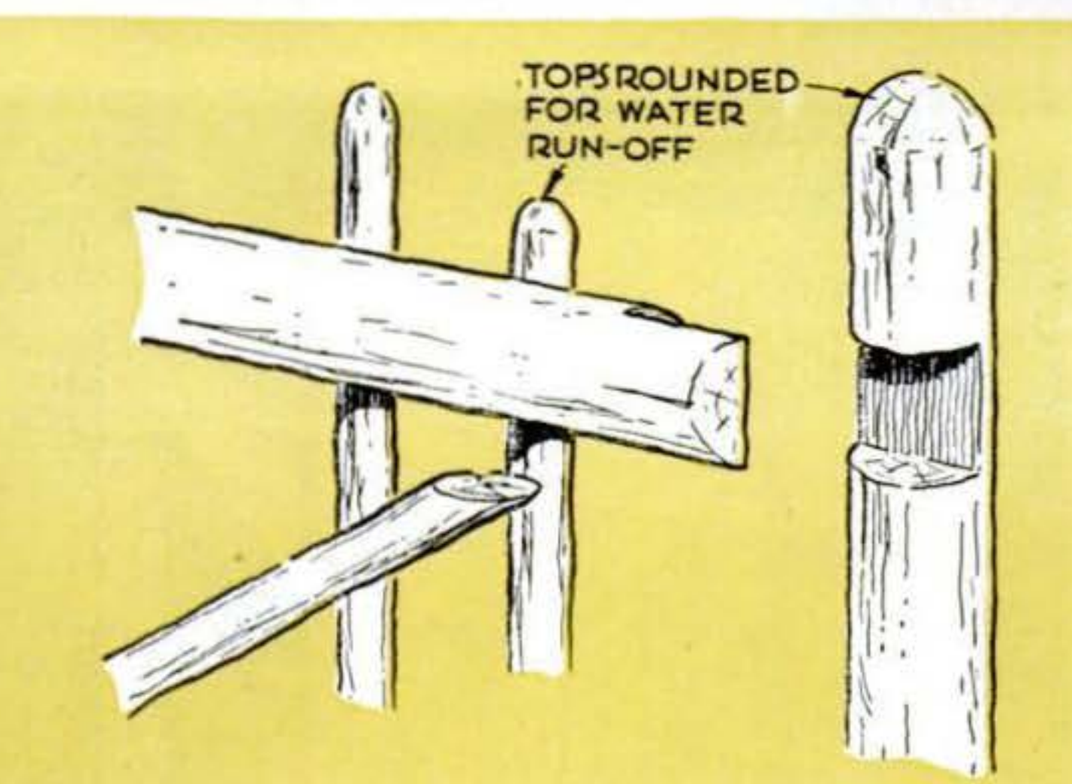
In this type of gate, uprights must fit tightly in rails. You can mortise rectangular holes or use any of the three simpler methods sketched. Seams could act as water traps; make sure they're snug, and then fill and paint them.



A long picket gate needs the support of diagonal braces. The tapering curves in gate and fence are provided by longer pickets. They add an interesting variation to the usual straight-line appearance of a picket fence.







A rustic gate doesn't suit every fence, but there are places where nothing else will do. Rail saplings were notched into end uprights. Other posts were nailed to the rails. A second diagonal might strengthen this gate.

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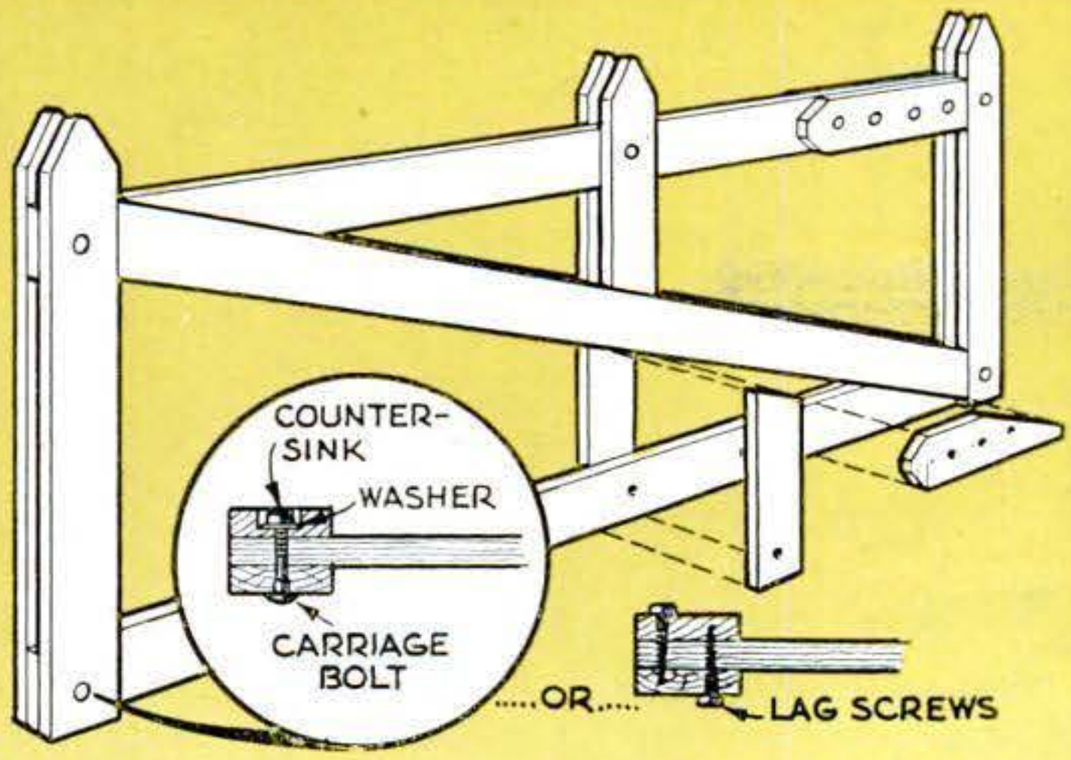
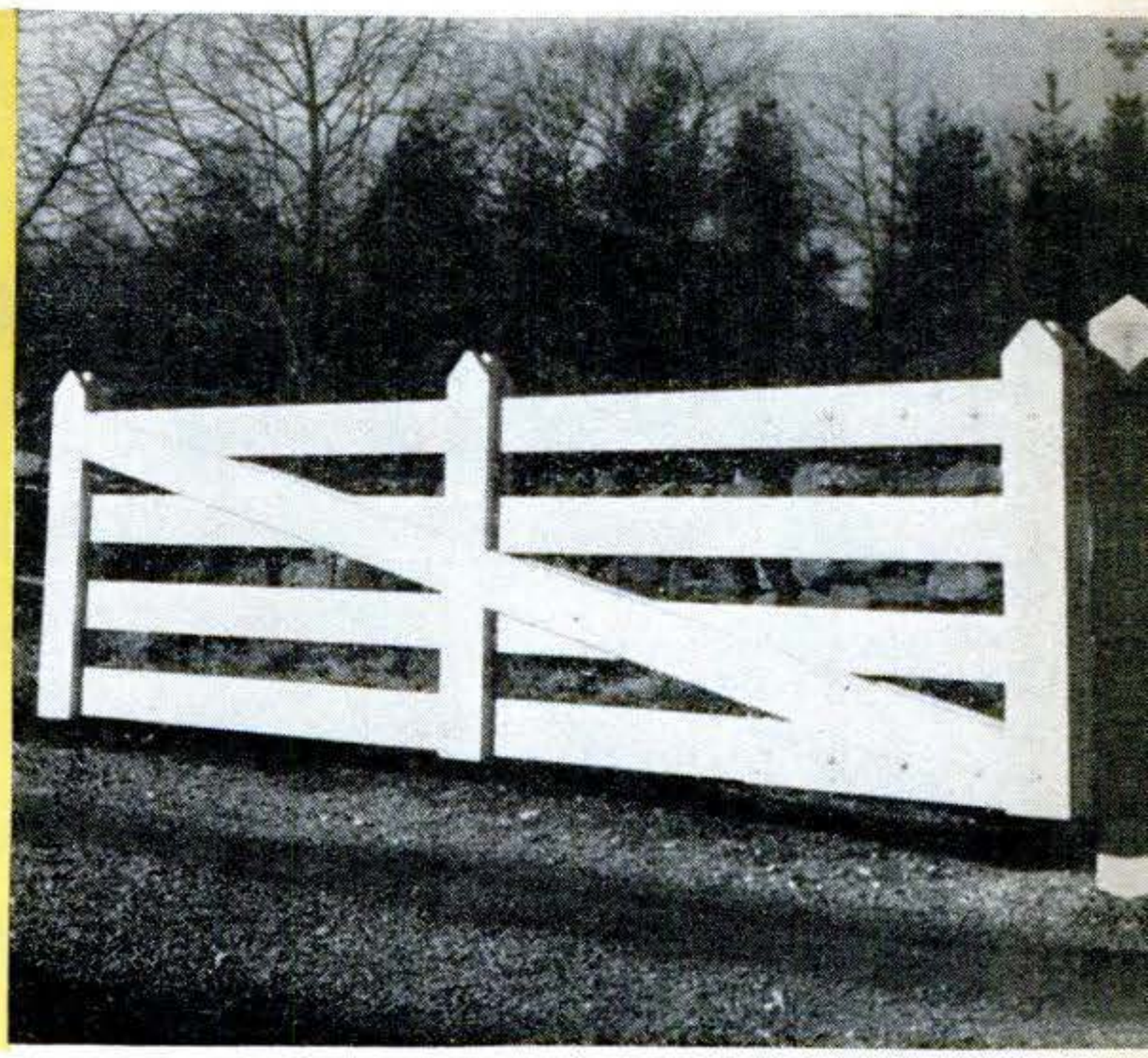
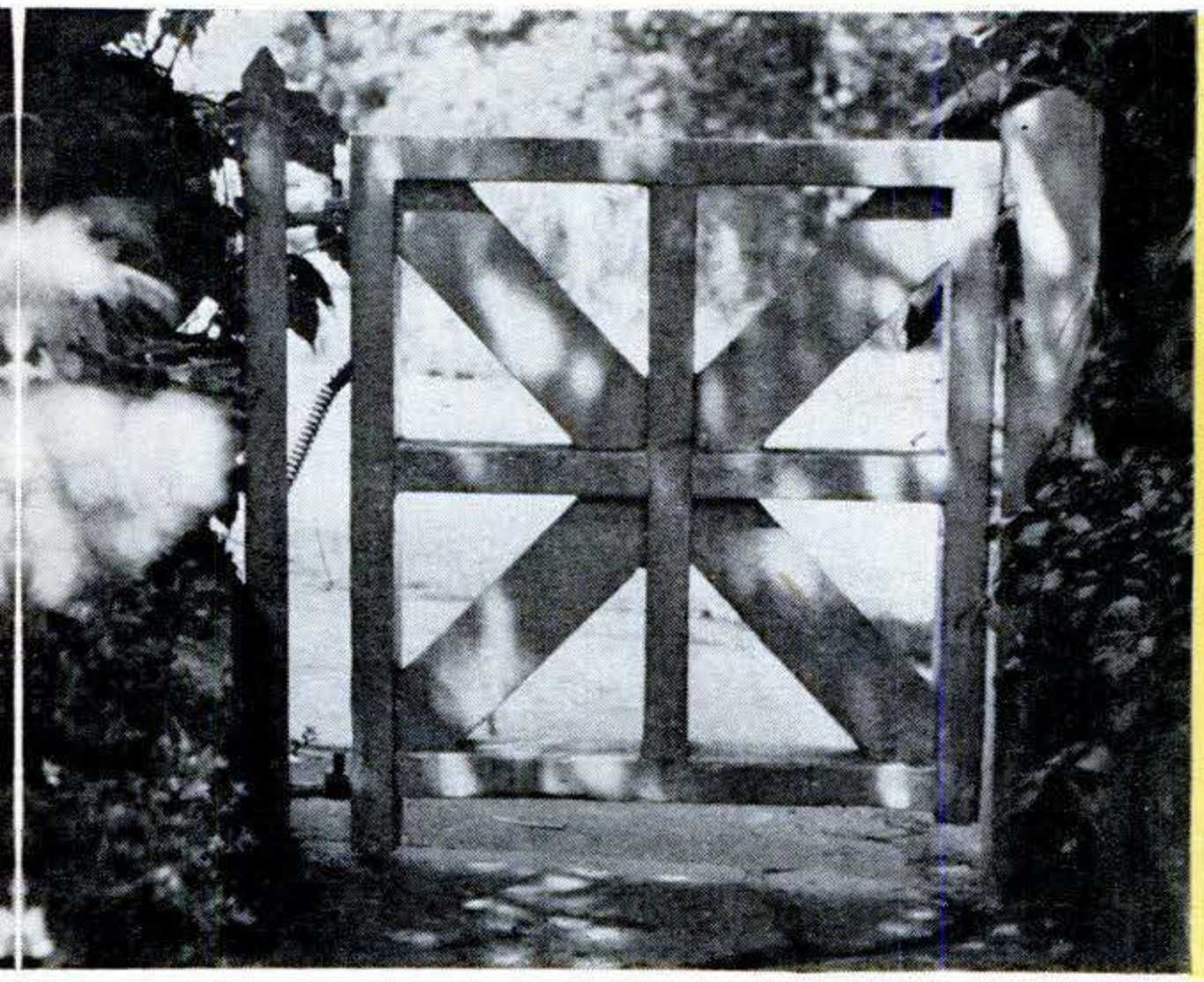
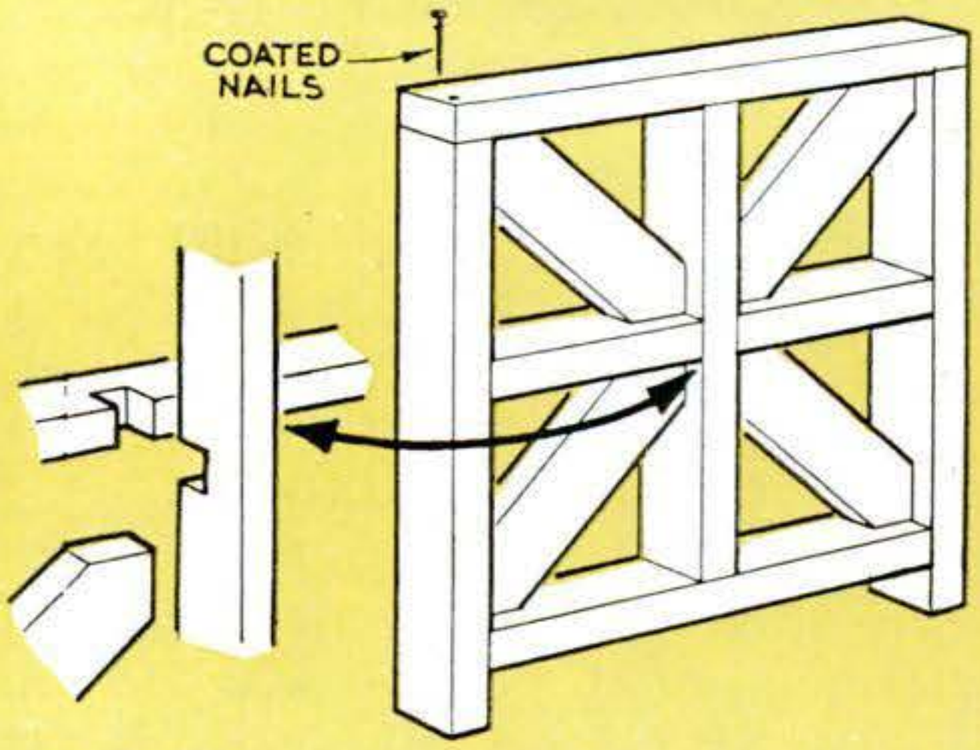


Driveway gate borrows its style from a corral. Three-ply, girder-like construction limits tendency to wrack or twist. Planks may be nailed and hinges secured with lag screws or carriage bolts. If bolts are used, nuts can be recessed.





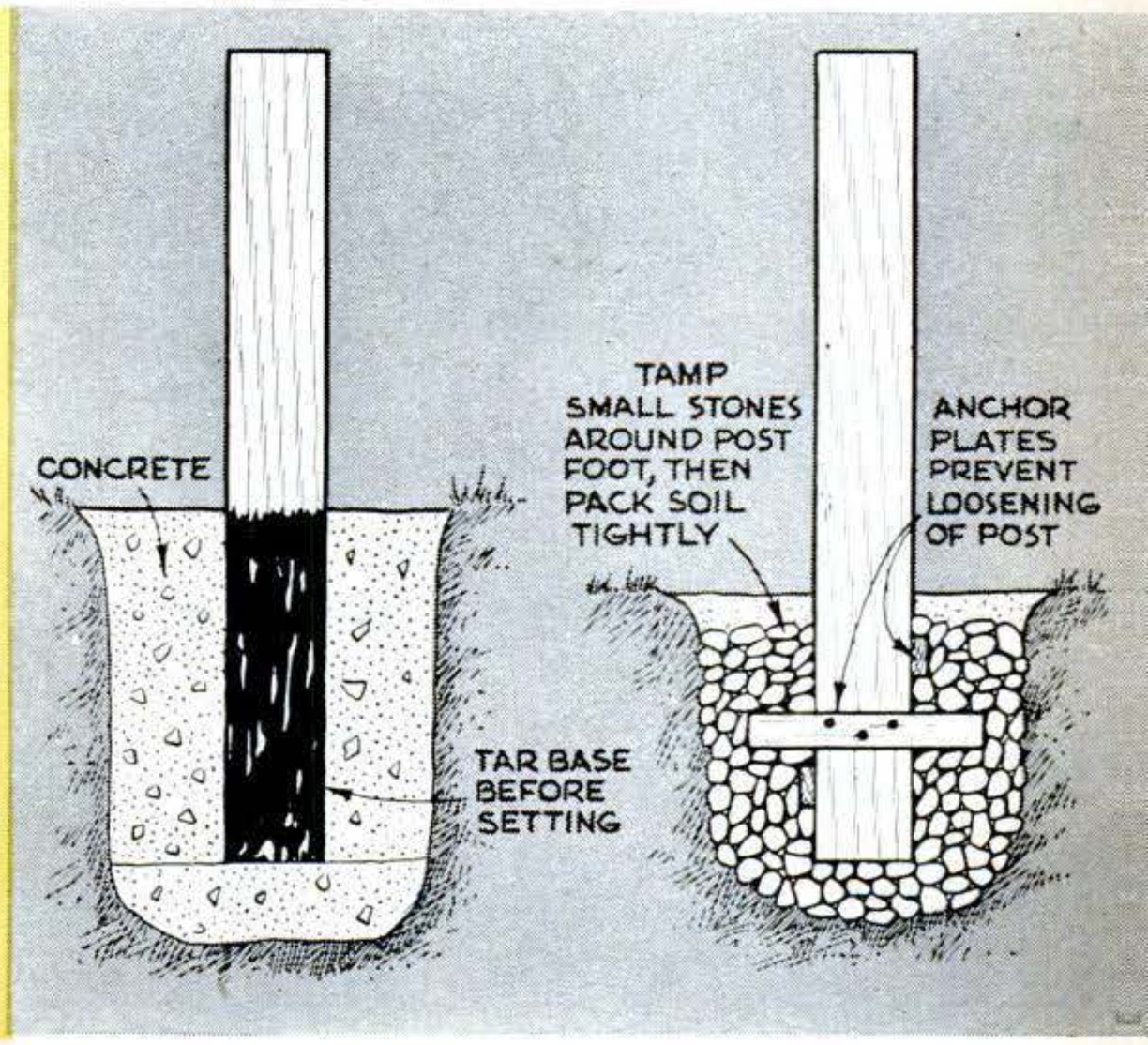


Two-by-fours were used for this gate. Horizontal and vertical braces are half-lapped; other joints are butted. Cracked paint and a missing foot suggest the gate's age, but despite the years it's square and sturdy.

A Strong Gate Needs Strong Gatepost

THE underground part of a gatepost is subject to rot and termite attack. Creosote is a good preservative but is difficult to apply properly without impregnating equipment. Whatever preservative used, be sure to pick a rot-resistant wood like cypress, locust, redwood, chestnut, or red or white cedar.

A 4" by 4" hinge post will support the average house gate. Set it 2 to 3 feet in the ground, tamp small stones around the base, and pack soil in tightly. If the ground is very soft, nail anchor plates to the base as shown, or set the post in concrete. A concrete footing is extremely strong but tends to speed rotting. To protect the wood, tar the base before you pour the concrete. END



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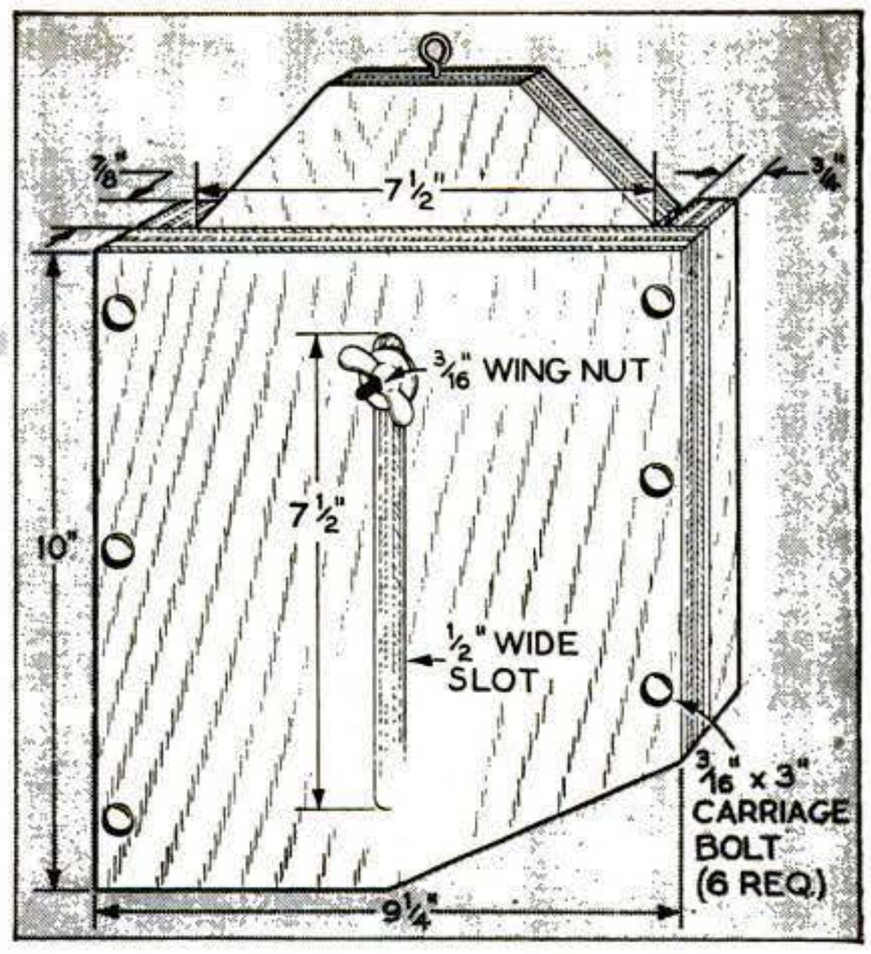
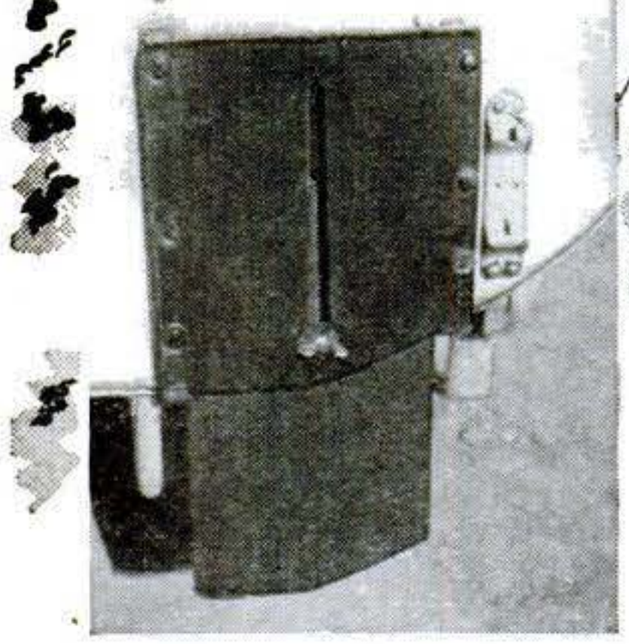




Plywood Trolling Plate Is Adjustable

Two hours' time, some scraps of ¾" marine plywood, and a few bolts turned out this trolling plate for my outboard.

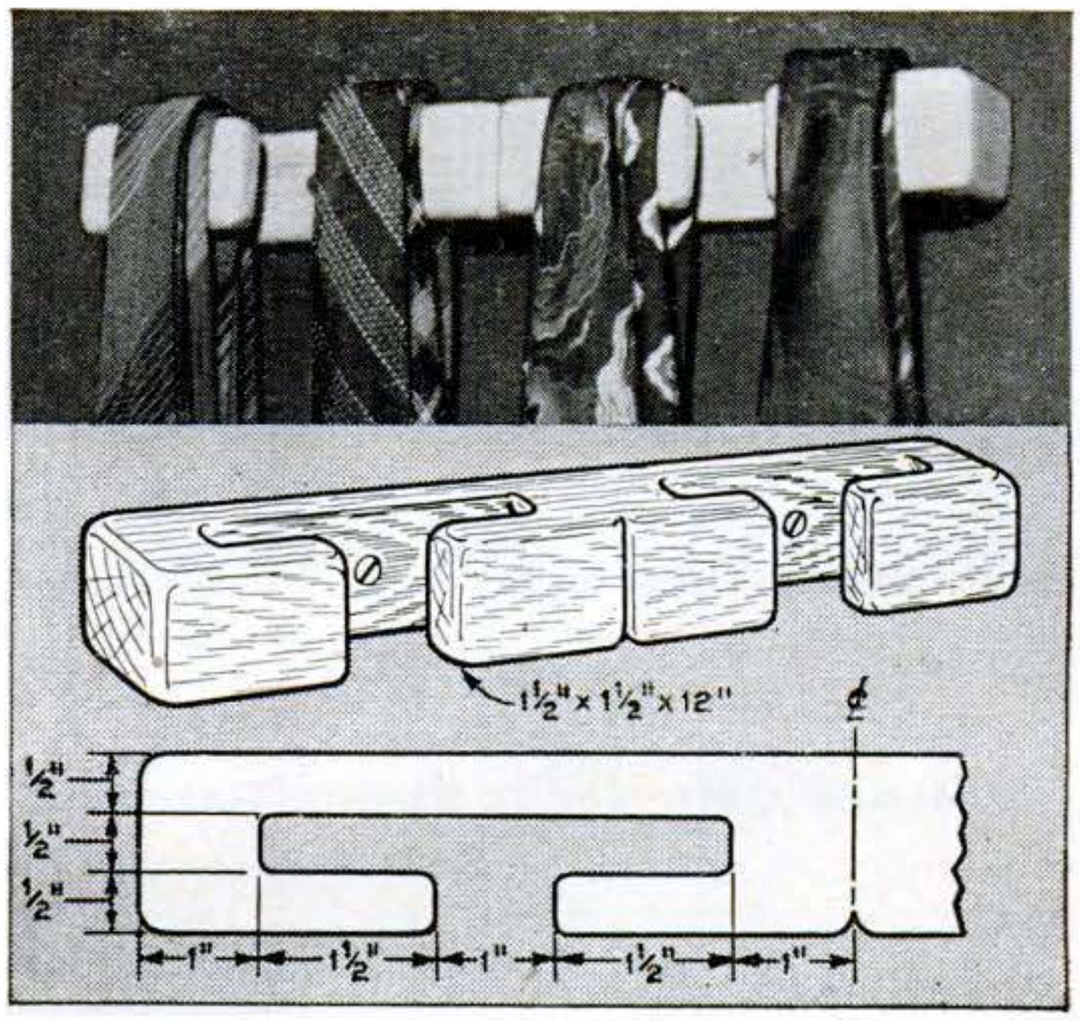
As you can see in the sketch, it's bolted to the transom to one side of the centerline. The photo shows the plate in trolling position. For straight running, loosen the wing nut and pull the plate up. Countersink the bolt for the wing nut so the bolt head doesn't scrape on the transom.

Apply three coats of marine varnish before assembling the plate.—*A. M. Chase, Wenatchee, Wash.*

Tie Rack Cut from Wood Block

A PIECE of wood 1½" by 1½" by 12" is all you need to make this tie rack. Draw the pattern directly on the wood (I used balsa) and cut it out with a coping saw. Round off all edges with a knife and sand the rack with medium and then fine sandpaper. Bore two holes for fastening the rack to door or wall and use countersunk wood screws.

Finish with two coats of clear varnish, lightly sanding the surface after the first coat has dried. If balsa is used, apply several coats of sealer first, sanding between coats.—*Frank Shore, New York City.*



Oilcan Keeps Dye from Evaporating

AN ORDINARY oilcan makes a handy, airtight container for marking blue or layout dye. Wedge the handle of the brush into the spout so that the bristles are kept immersed in the dye and air is sealed off.—*W. H. McClay, Pasadena, Calif.*

Quick Substitutes for Sail Battens

FOR small sailboats, yardsticks cut to desired length will do very well as sail battens. Sand the edges round and round one end so the stick will be easier to insert in the batten pocket.—*Jim Miller, Moline, Ill.*

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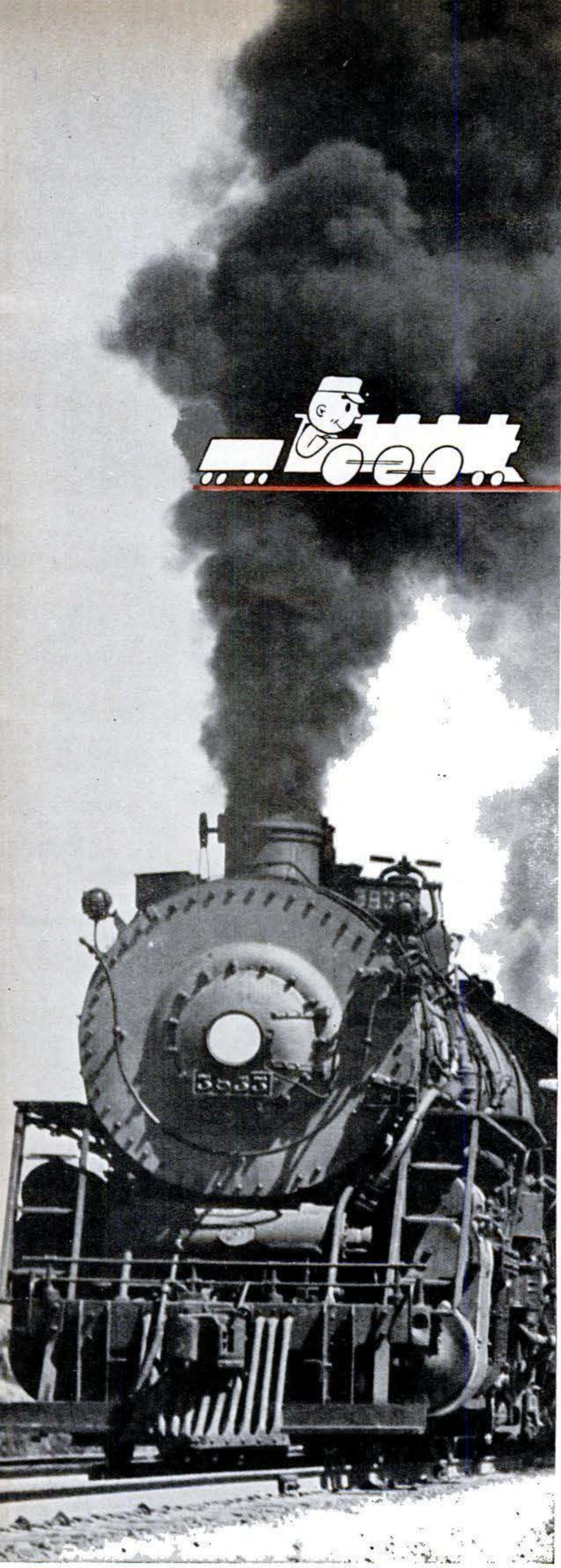
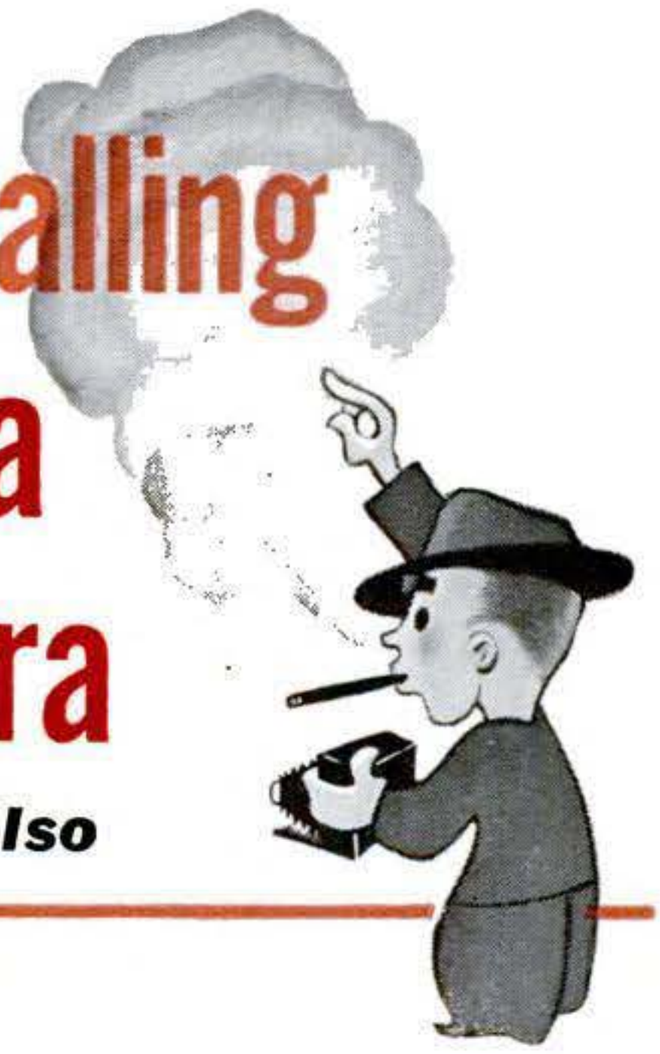


Highballing with a Camera



By H. L. Kelso

Puffing a cigar to let a fireman know you want stack smoke is a trick of the trade in railroad photography.

JUST let me hear a mighty locomotive at work on a grade, or the long low moan of a steam chime whistle, and my trigger finger gets as itchy as the meanest western gunman's. For I love trains—and make a hobby of photographing them.

For good railroad pictures, nothing sensational has to happen. But there's never a lull. Any true enthusiast will tell you there's no more impressive sight than a steam locomotive with side rods and drivers flashing and its stack spouting smoke and steam to high heaven.

In my book the most thrilling of all railroad pictures is a speeding train coming practically head on. Another favorite type is known to railroad photographers as a smokeroo. This requires smoke from the stack, the more the better. However, heavy black smoke indicates a waste of fuel, and a good fireman tries to keep it down.

The surest way to get smoke is to arrange for it in advance. After picking my shooting spot, I go to where a train has stopped and make a deal with the engine crew for plenty of smoke when they come by. Some smoke of your own, in the form of a couple of cigars, is generally considered a fair trade.

If it's impossible to arrange for smoke in advance, I light up a cigar while the train is approaching. Puffing heavily on the

Smokeroo. That's what train photographers call shots like this one of the Santa Fe's Grand Canyon Limited.

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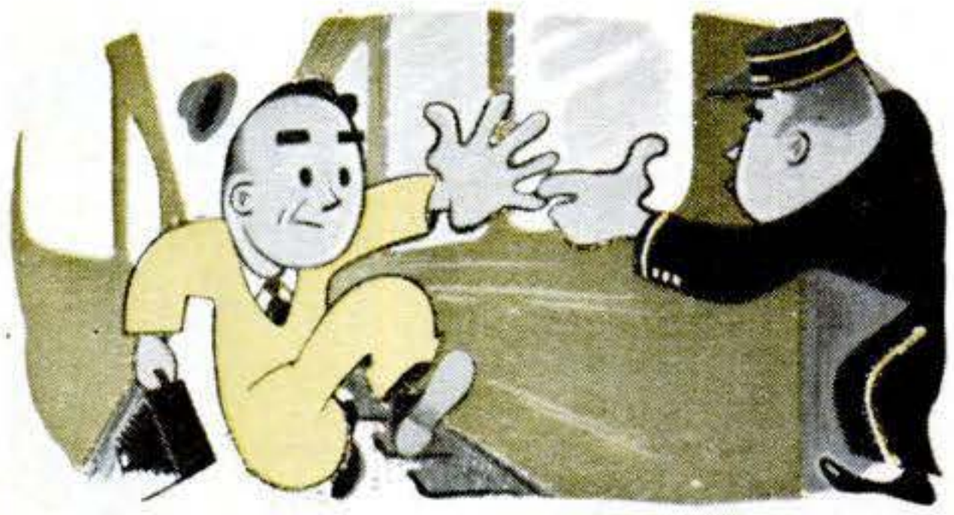
cigar, I point to it to attract the attention of the fireman. Nine times out of ten he gets the idea and changes the firing controls to produce smoke.

To get my pictures, I ride trains, I wait for them along the right-of-way, and I visit the yards and roundhouses.



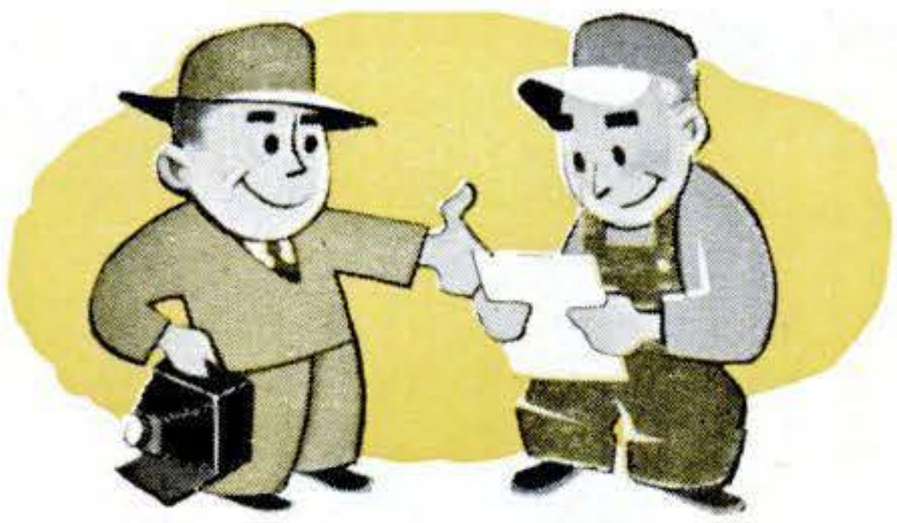
Footrace with a train

One of my most successful photos was taken while I was an eastbound passenger on the Golden Gate, the Rock Island-Southern Pacific's famous streamliner. From the crew I learned our train would pull into a siding to let the westbound Sunset go by. The Sunset was then a brand-new streamliner and action pictures of her were much in demand.

I arranged with the brakeman to let me get off to shoot the trains as they made the "meet." Since the rear car had no rear door, I had to walk the length of the car, plus about 40 feet more, to get behind the train for the shot.

When the westbound train cleared the east end of the siding, my train would begin moving out to the main line. To get the kind of picture I wanted, I had to wait until my own began to move, fire the shutter, and then run like blazes to catch up.

Now running 100 feet or more between two moving trains and swinging aboard with a bulky 4″ by 5″ Speed Graphic is no mean feat. Try it some time. Had I failed to catch up, the train would have been stopped. But my friend, the brakeman,

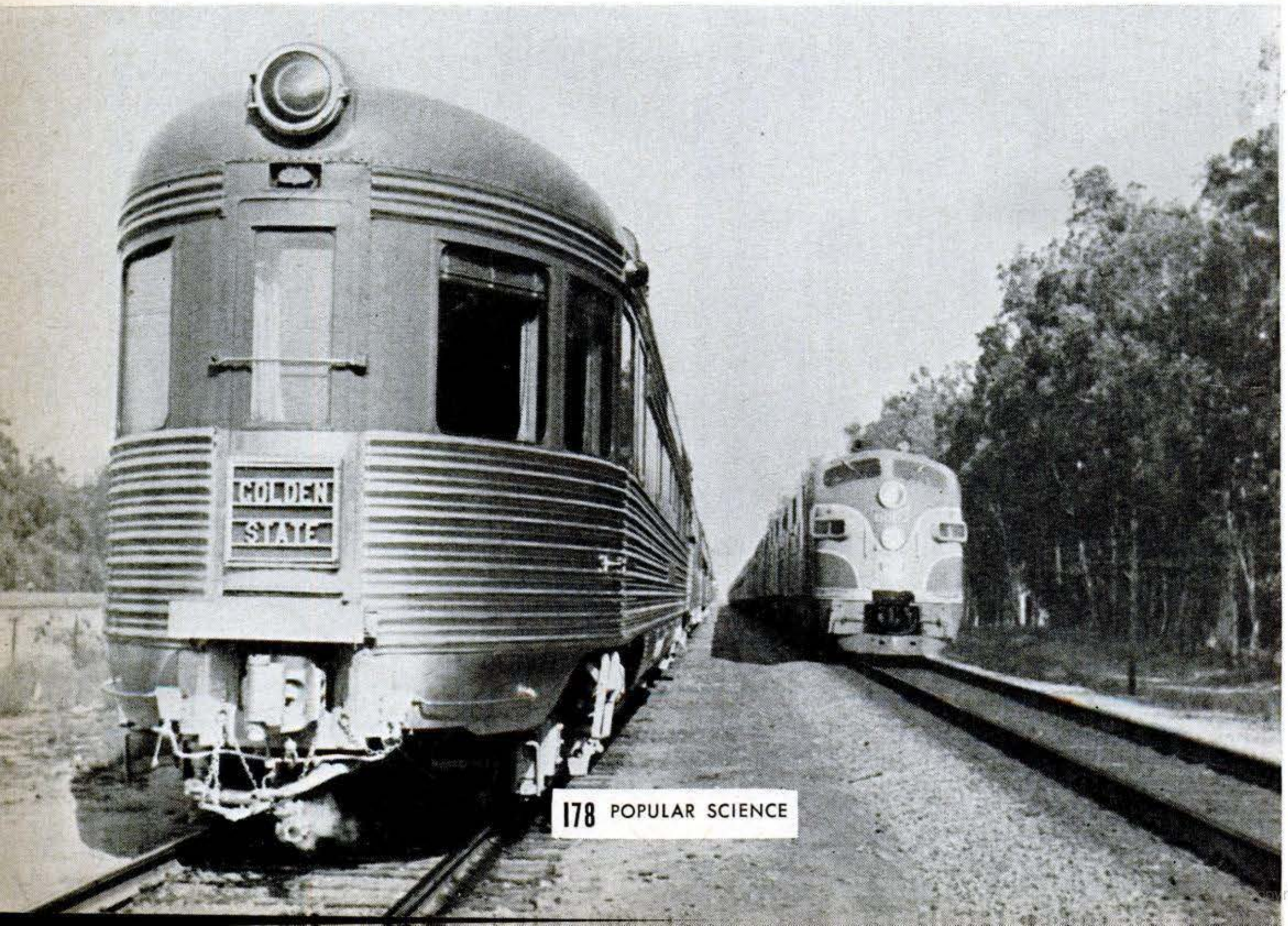


Gift photos pay off

would have had no end of trouble explaining. Trains like the Golden Gate are not run for the convenience of photographers.

But most railroaders are willing to co-

Famous streamliners meet. For this photo, cameraman turned sprinter to catch his own train. The exposure was made on fast panchromatic film at a setting of 1/400 second and f/16.



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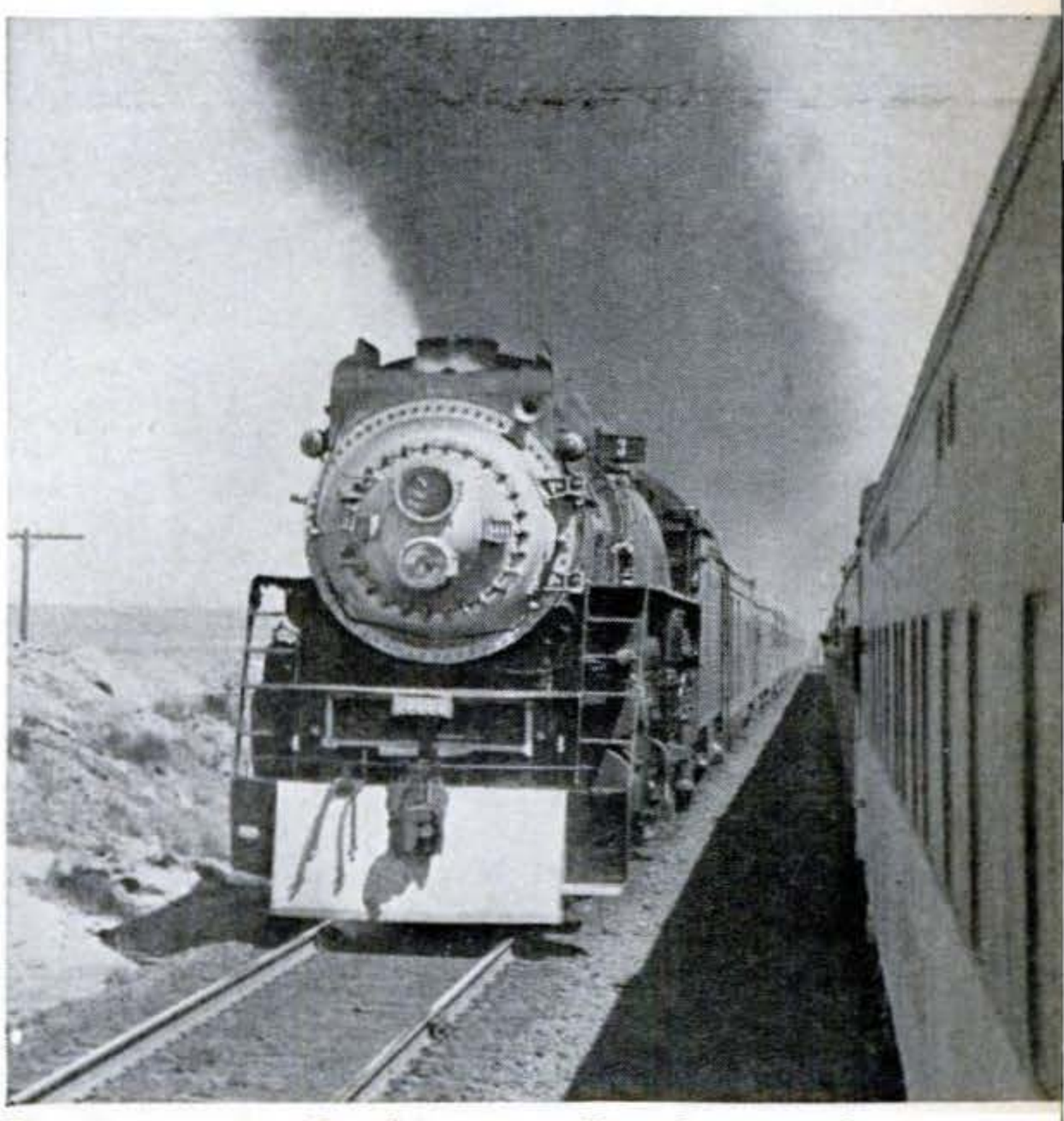
operate if you give them a chance. I make it a point to take pictures of the railroad men themselves—and follow through by giving them prints. This will pay dividends.

Ouch! My aching ears!

Like other photographers, I get an idea every now and then for an exhibition picture. One such attempt, the blowing locomotive whistle, nearly cost me my hearing.

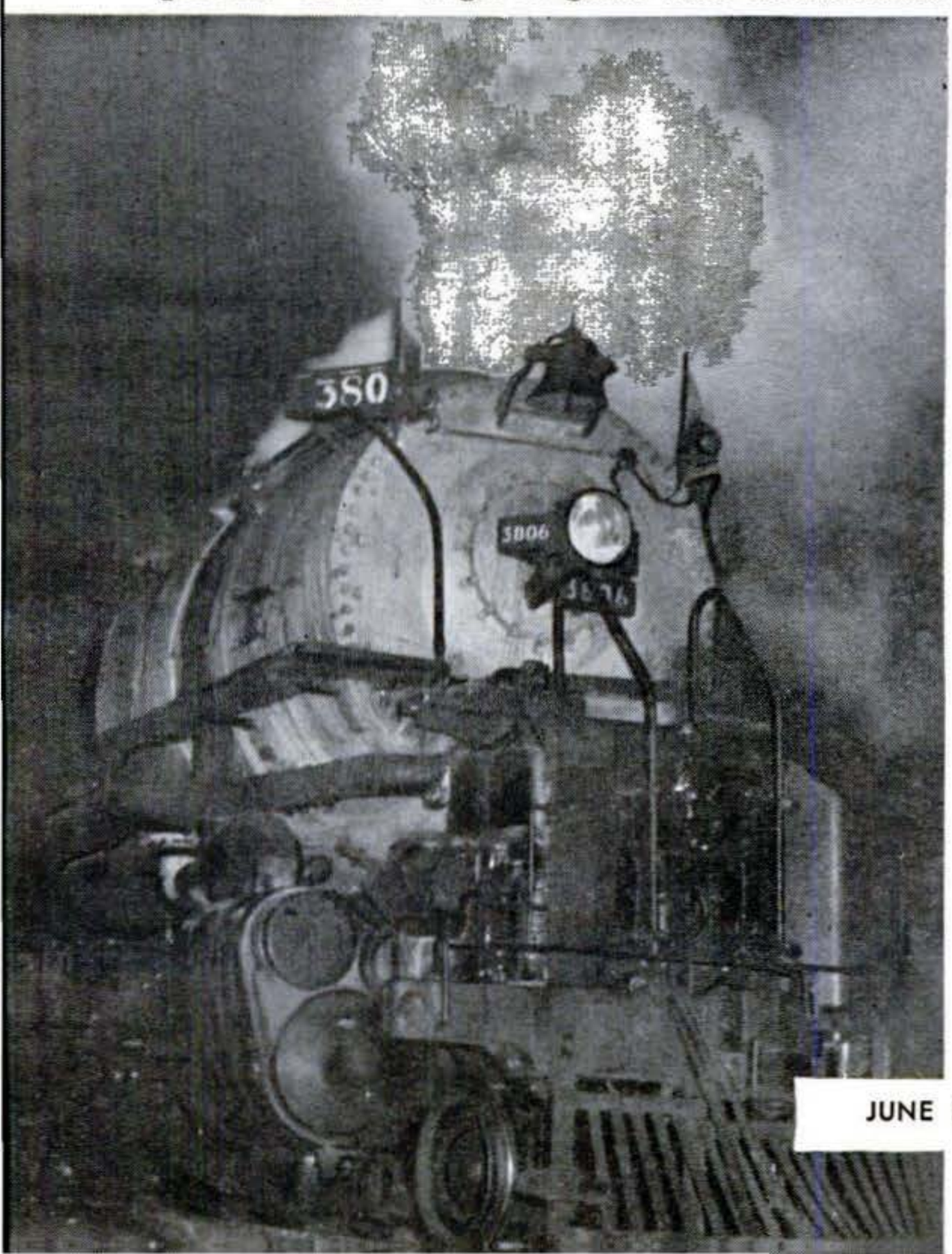
I had arranged with an inspector so I could perch on the locomotive while he blew the whistle. Now a whistle sounds grand from a distance, but it becomes an ear-splitting shriek at only eight feet. Out of sight on the other side of the cab, the inspector decided to give me plenty of time to take the picture. All I could do was hang on—and hope he would release the whistle. It was some time before I could hear again or stop shaking. END

Whistle talk. From eight feet away, it looked loud—and sounded worse, photographer says.

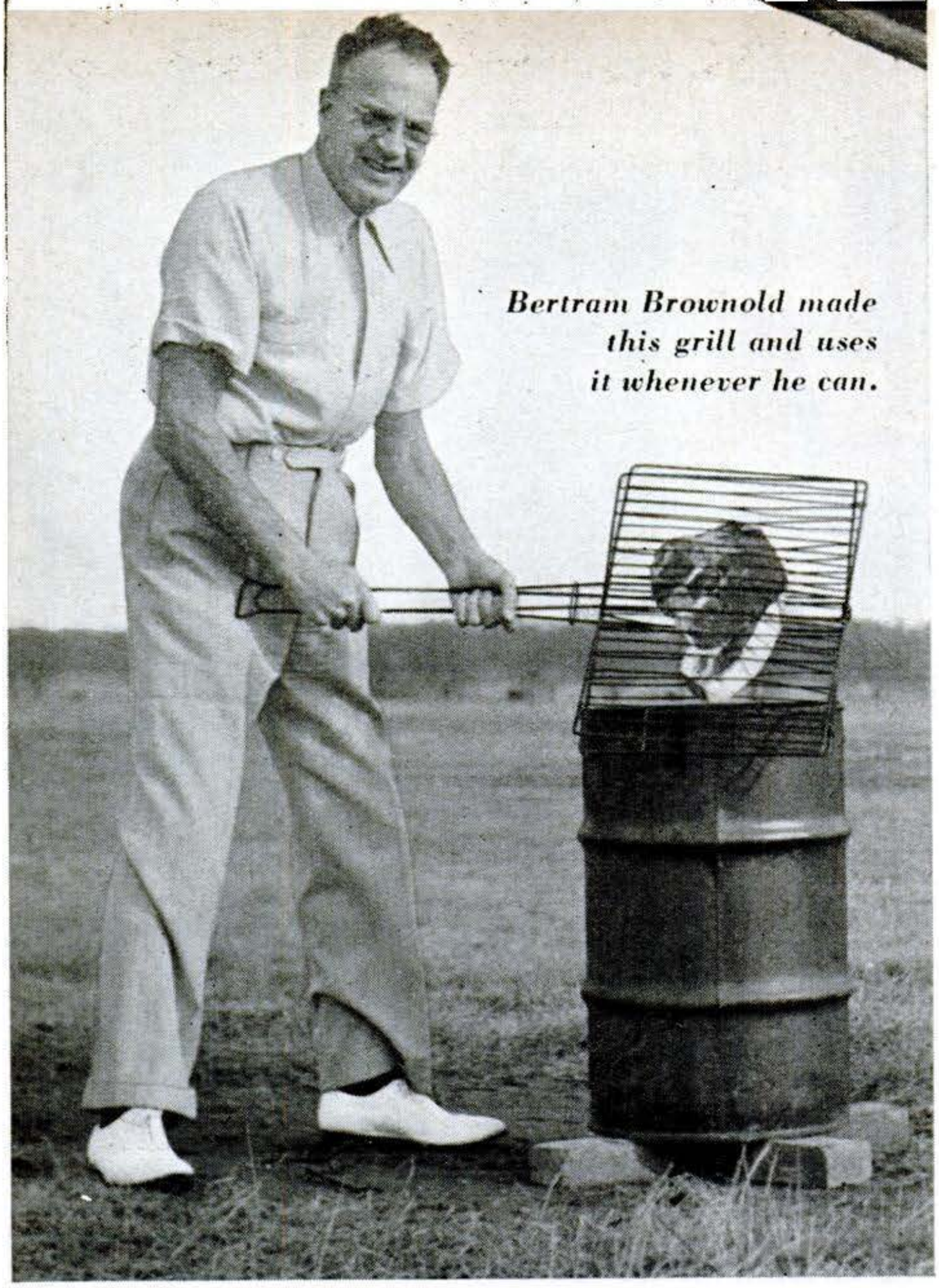


Passing train. In this case, the photographer was a passenger on rear car of train at right.

Night run. Using flash, you can shoot night photos. A 45° angle is good with locomotives.

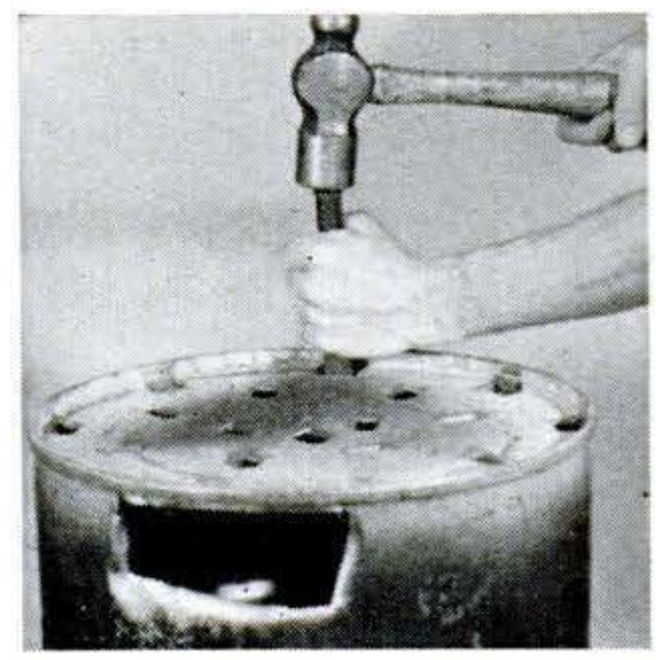


In the yards. This dramatic photo was shot into low morning sun as experiment in lighting.



Bertram Brownold made this grill and uses it whenever he can.

Cut out head of drum, using hammer and cold chisel. File off rough spots.



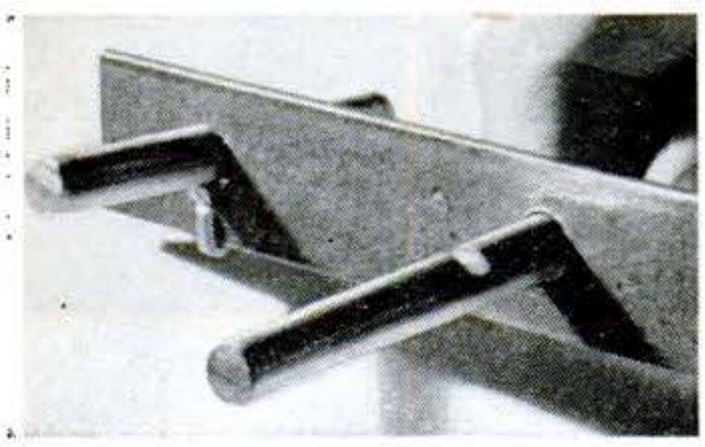
Punch bottom holes for draft and cut side opening for stoking, ash removal.

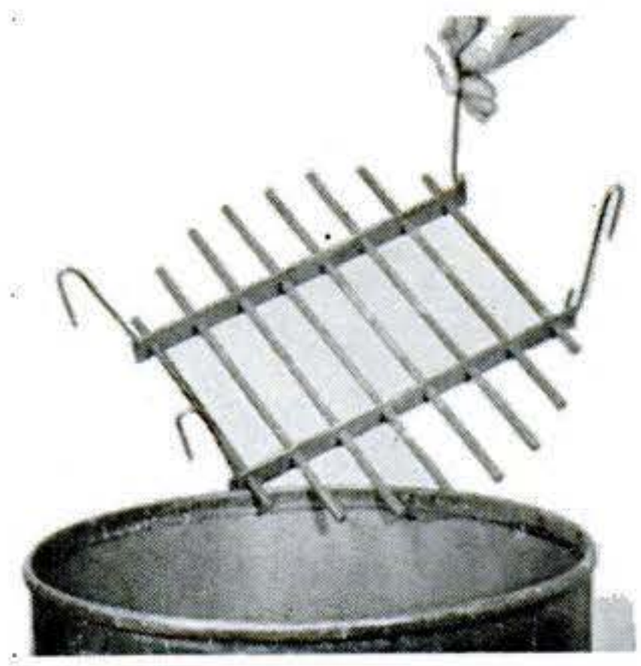
My Outdoor Grill Is Safe and Portable

You can build one like it for back-yard broiling.

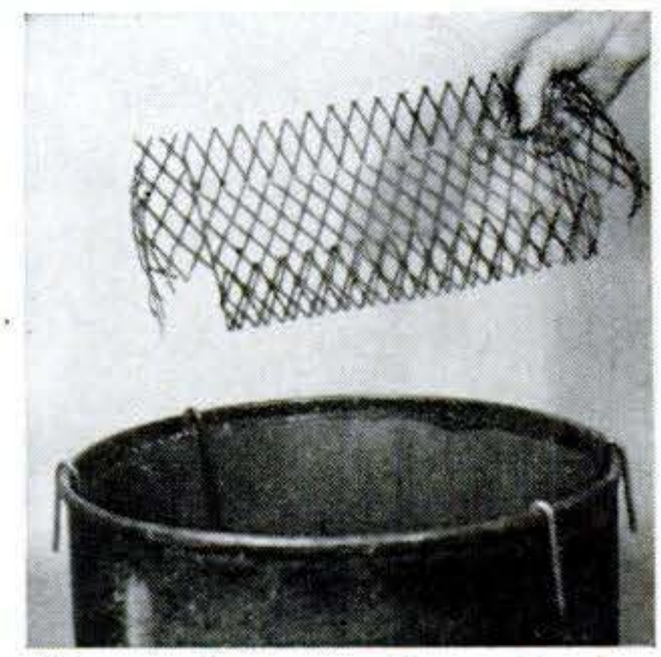
ONCE you taste charcoal-broiled steak, you just don't want it any other way. Store-bought outdoor grills can cost as much as $125, but you can make this one from an old 30-gallon oil drum, which is generally yours for the scrounging. It will do nearly anything that costly grills do. Its fire is so well guarded that it can be used in a small back yard. And it fits into the trunk of a car for picnics.

For the grate, drill ½″ holes in the iron strips. File notches in ½″ rods where they pass through, and push the strips into these notches. Into the crescent-shaped gap left below each rod, drive a small cut nail, bending it around the strip to lock it. Use the grate alone for a big broiling surface. Burn wood on it to start charcoal going in the wire box when a smaller surface will do. Clean the drum well.





Grate of ½″ iron rod and ⅛″ by 1″ flat iron strip is suspended inside drum.



Make charcoal box of wire lath, with two sides long enough to hook over drum.

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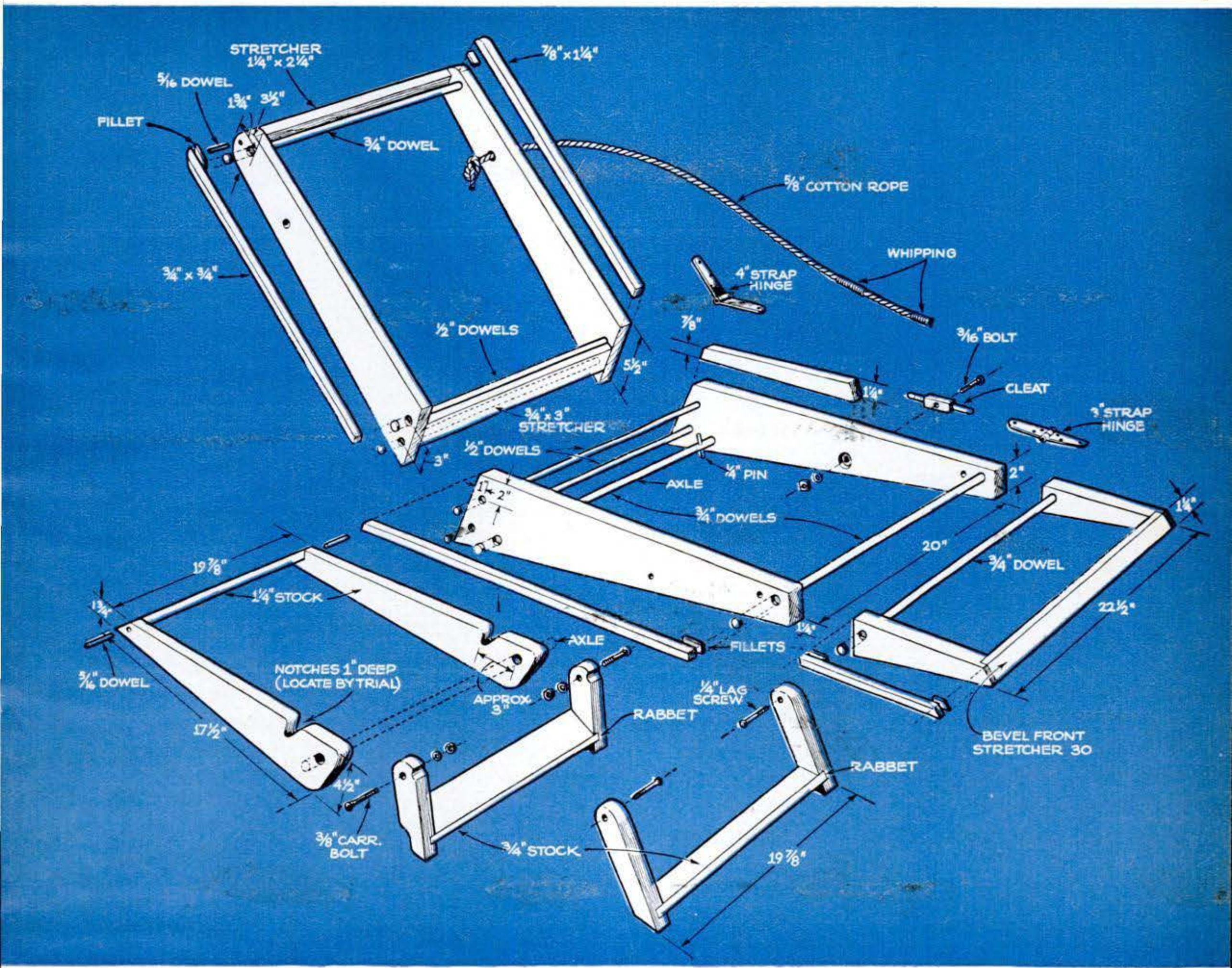

I BUILT the lounge chair pictured here with about $10 worth of materials, which is much less than I could buy a comparable chair for in any store. It was easy to build, too—and it is comfortable and portable, as well as modern looking.

As you can see in photos on the opposite page, the chair folds neatly for carrying. But, unlike some outdoor furniture, this lounge won't fold up unless you want it to. And you don't have to be a mechanical engineer to figure out how it works. You pack it in three easy moves. Another feature is the movable back. You don't have to stand up to readjust it.

For my chair I used 1¼" pine. The webbing is 1¾" heavy nylon straps, but canvas straps could be used instead.

Frame assembly. Cut out all frames—for seat, back, and foot extension—to the dimensions and angles shown. Then drill all the holes indicated.

Next glue in all the dowels except the axle dowel. There's only one axle dowel. It's near the rear of the seat frame. Glue the other dowels in the holes so the frames will be exactly 20" apart, inside measurement. Cut the dowels a bit short, to leave about ¼" recess at each end. Glue deck plugs into the holes and sand the plugs flush with the outside of the frames. Deck plugs are round, wooden plugs with the grain running across. You can make them, or buy them at marine supply houses and some hardware stores.

Install the three stretchers in the frames. Fasten the stretcher at the top of the back with 5/16" dowels. Use finishing nails from outside to hold the ¾" by 3" stretcher at the bottom of the back frame. Half lap the extension stretcher into the frame, using finishing nails. Waterproof glue should be used on all joints.

Leg assembly. While the frame glue is setting, cut out the leg parts. Full-size pat-

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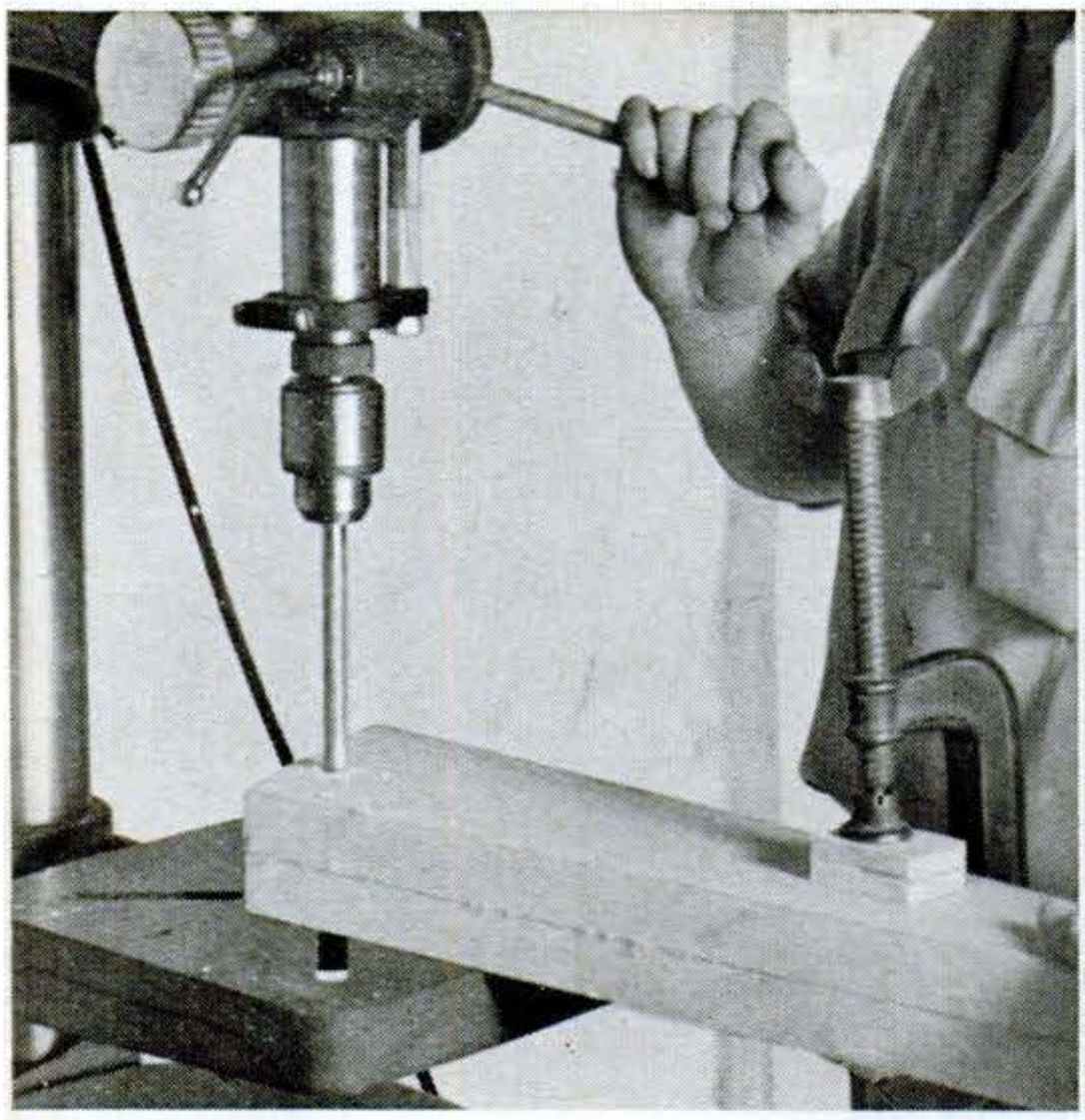
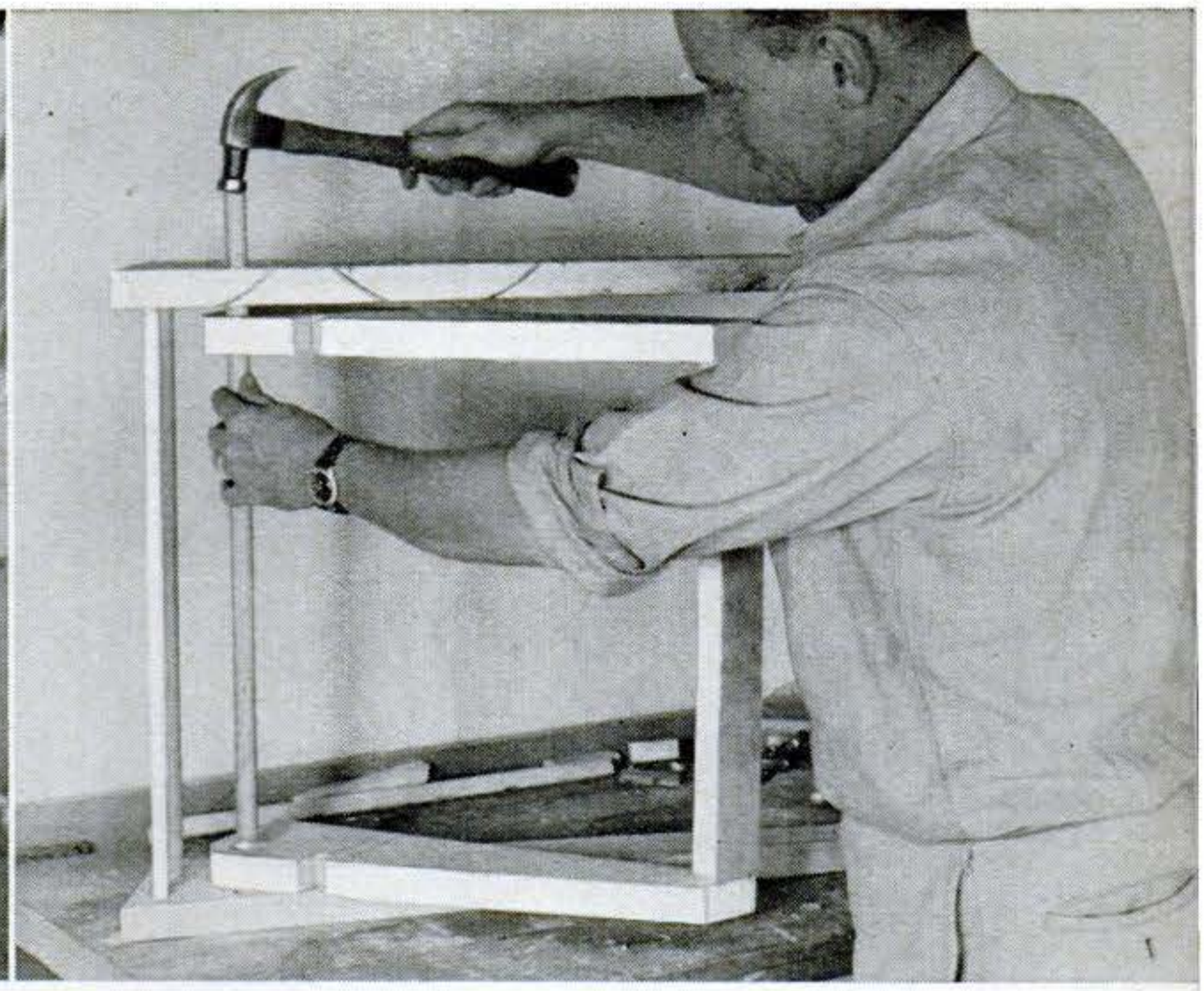


Drill all holes for dowels with members of opposing pairs clamped together. That way you'll have all opposing holes exactly lined up.



Test the fit of the back-leg assembly on the axle dowel. Notches have already been cut in this photo. This is the final check.

terns will help and avoid waste of material. Drill the holes with the parts clamped in pairs. Then assemble the leg parts with glue and dowels or glue and finishing nails, as indicated in the drawing. Outside width of all leg assemblies is 19⅞".

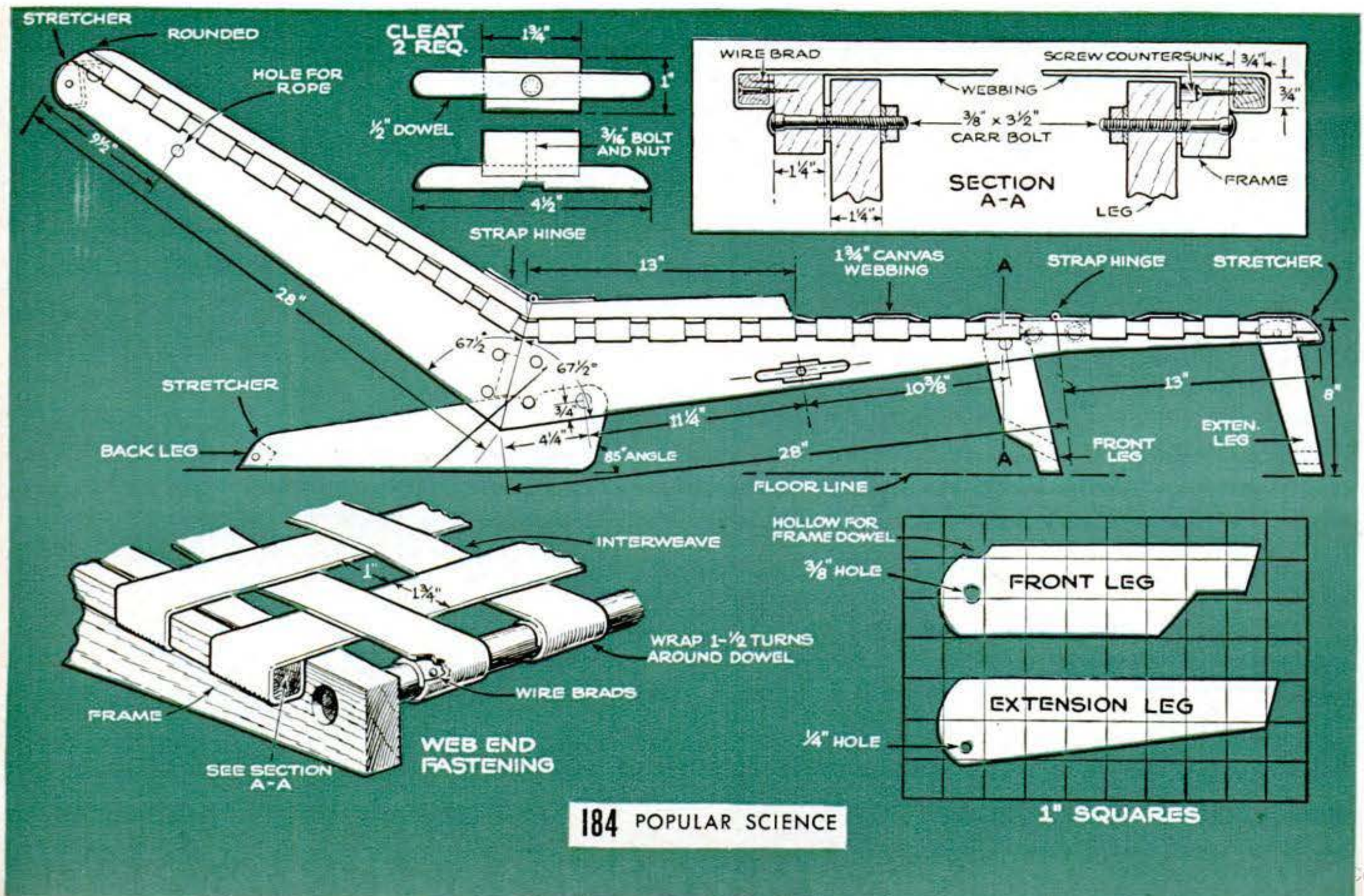
Seat-control notches. Temporarily bolt the front-leg assembly to the seat frame. Also run the axle through the seat frame and back-leg assembly. Bring the back legs against the lower ½" dowel of the seat frame and mark the legs for the notches.

The depth of these notches controls the slope of the seat. As indicated in the drawing, they give a very slight backward slope. Cut shallower, they will result in a level seat; cut deeper, a greater backward pitch.

Remove the rear legs and cut the notches with a jigsaw and round file. Then put the legs back on and test for seat cant and leg folding. The back legs should fold in first with front legs over them, all flush within the frame structure.

Stringing webbing. It's easier to do the webbing with the legs removed. I left them on, however, so that my photos would show more details.

You'll need 34 yards of webbing for the



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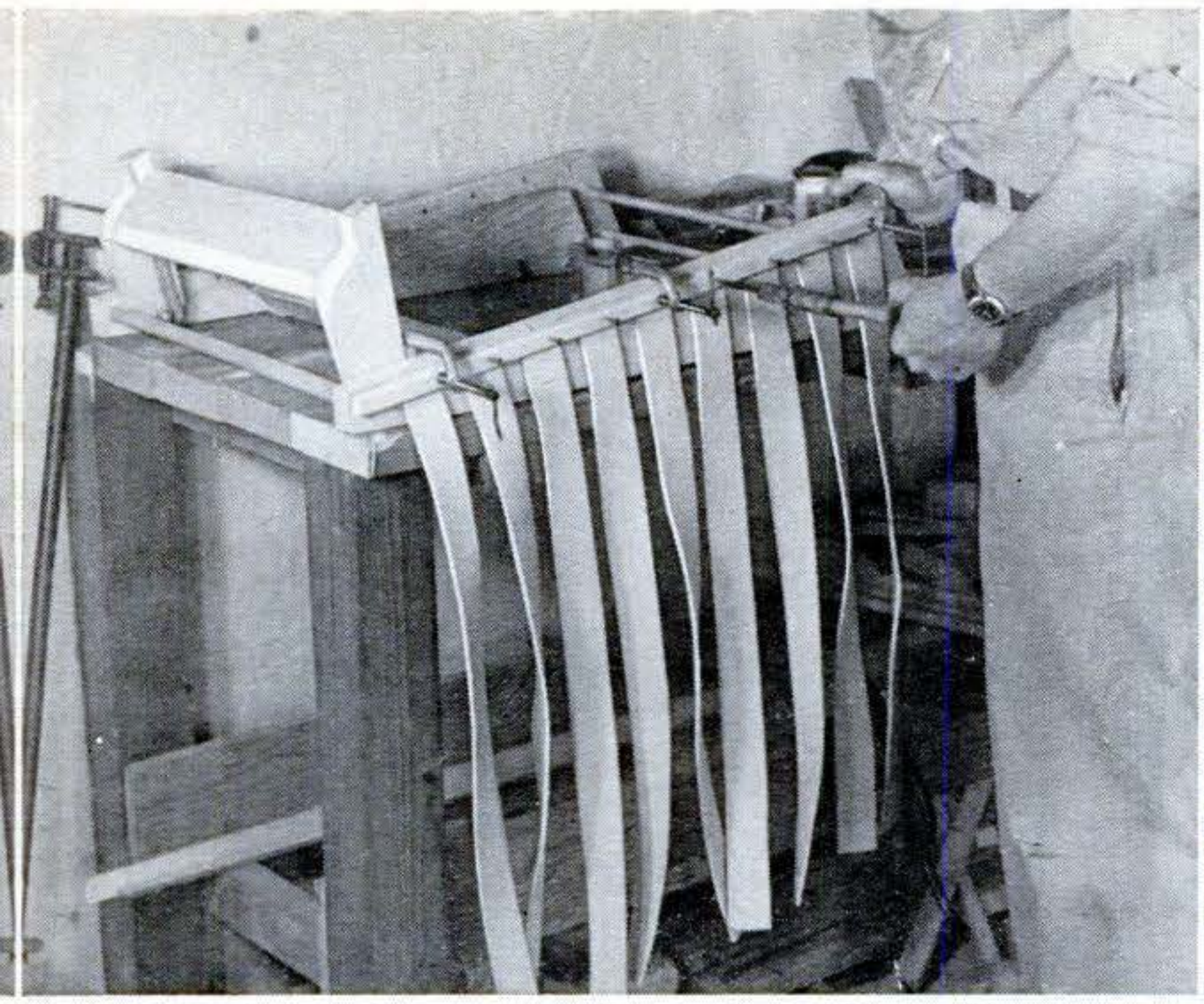
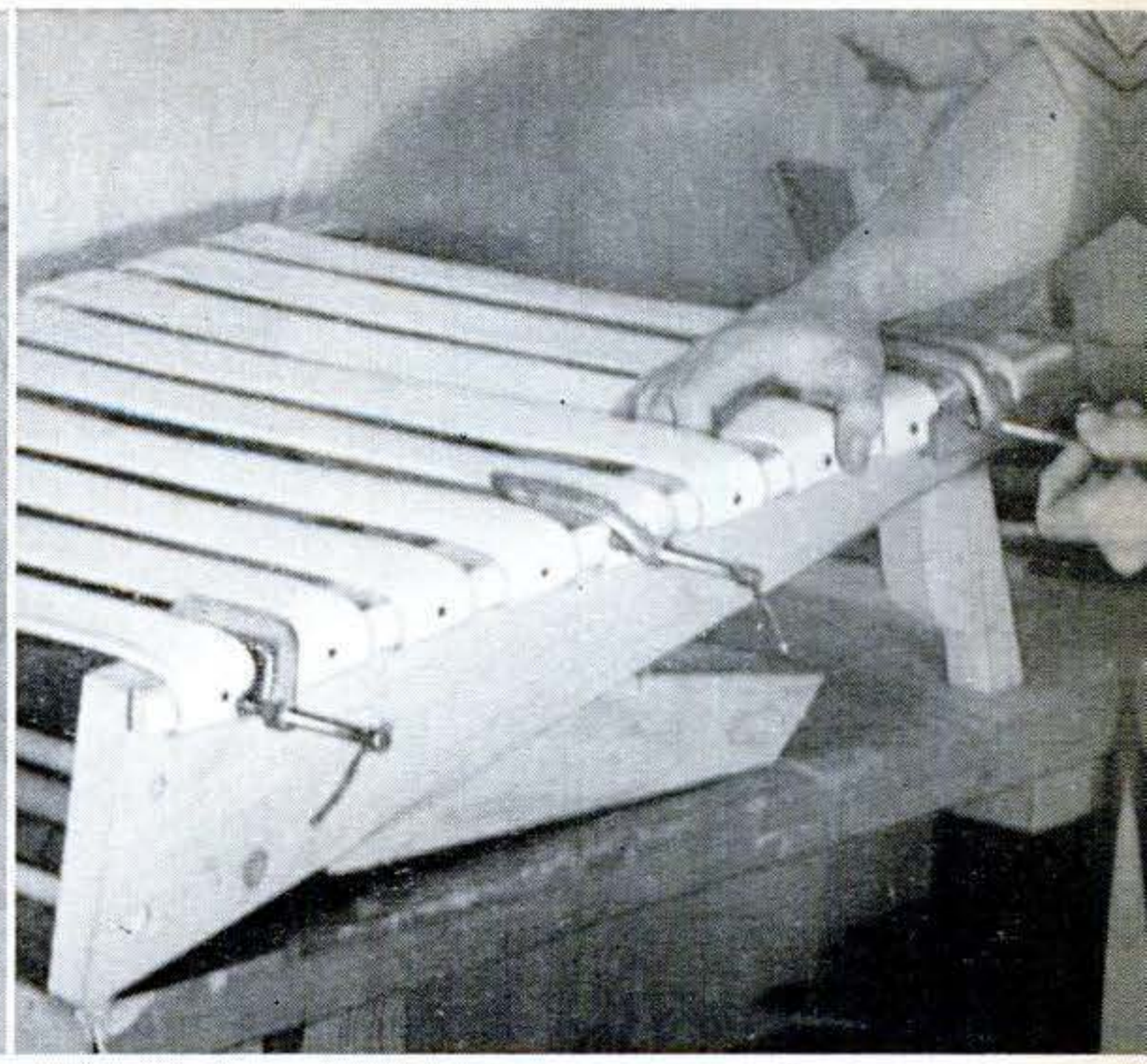


Screw first retaining strip to frame from outside of frame after fastening webbing with brads. They hold better than tacks.



Clamp opposite retaining strip to frame after bradding other ends of webbing to it. Drawing on opposite page shows webbing details.

seven lengthwise and 22 cross strips. Don't cut any straps until you measure for length. And don't measure with a tape. Use the webbing itself because its thickness will affect the length.

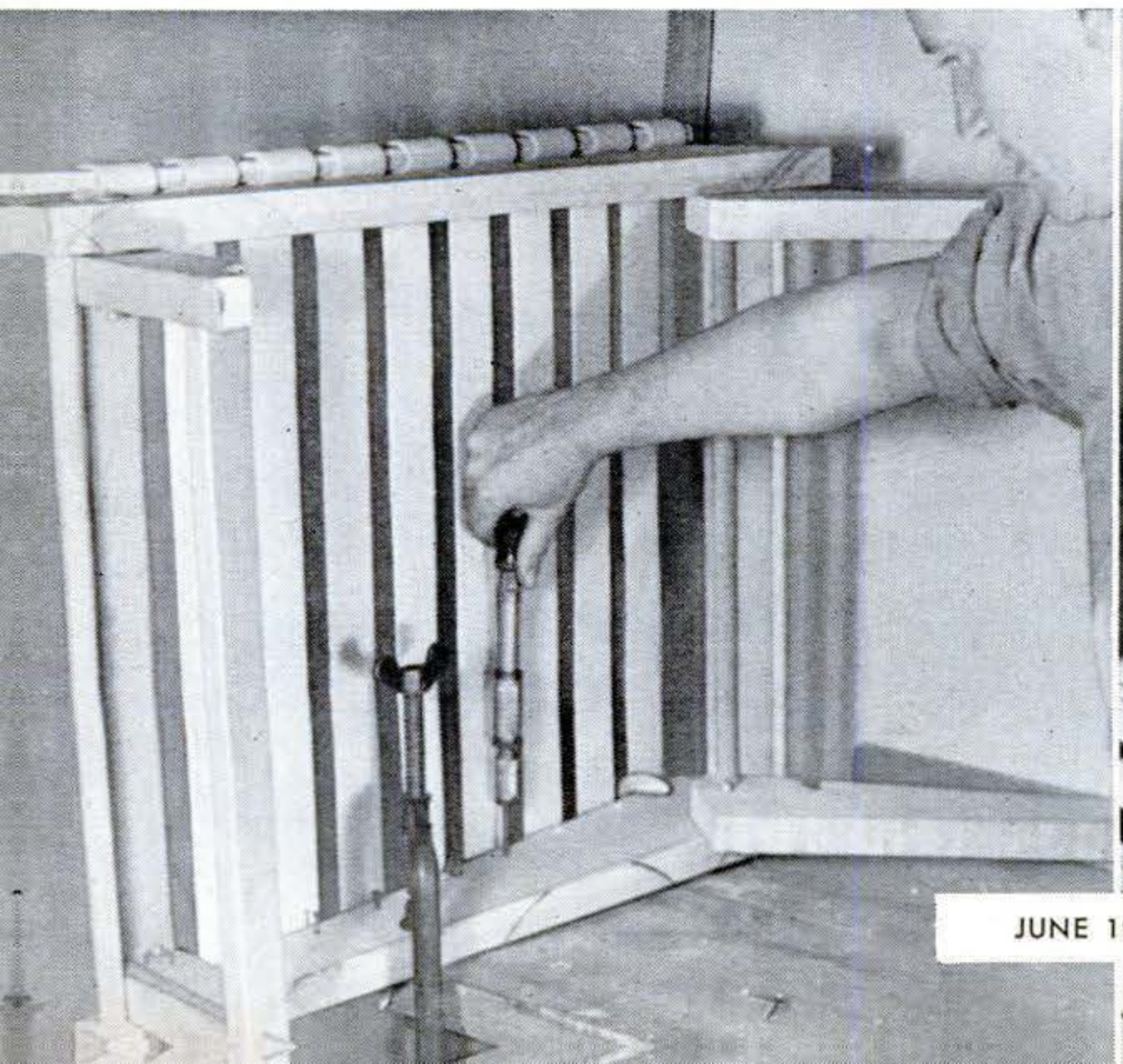
Photos and drawings show you details of stringing. After you've put on the cross straps, attach the ⅞″ by 1¼″ top strips that take the 4″ strap hinges with No. 4 or No. 6 casing nails and set the heads. Then hinge the back to the seat with 4″ strap hinges and the seat to the extension with 3″ hinges.

Brad the lengthwise webbing to the ¾″ dowel at the front of the seat. Weave the lengthwise webbing through the cross straps. Bring the ends over, around, and under the top stretcher and brad them there.

Finishing touches. Bolt the cleats to the sides with the nuts countersunk inside the frame so they won't foul up when you fold the legs. Knot 4′ of white cotton rope through the holes in the back frame. When adjusting the back, you only have to release the ropes from the cleats.

If you want to paint your chair, do it before you put on webbing. A natural finish can be applied after the webbing is on if you do it carefully. END

Second retaining strip is screwed to frame from inside the frame. Countersink these screws so heads won't interfere with folding of legs.



Join back and seat with 4″ strap hinge after cross webbing is in place. Use 3″ strap hinges to connect foot extension with the seat.

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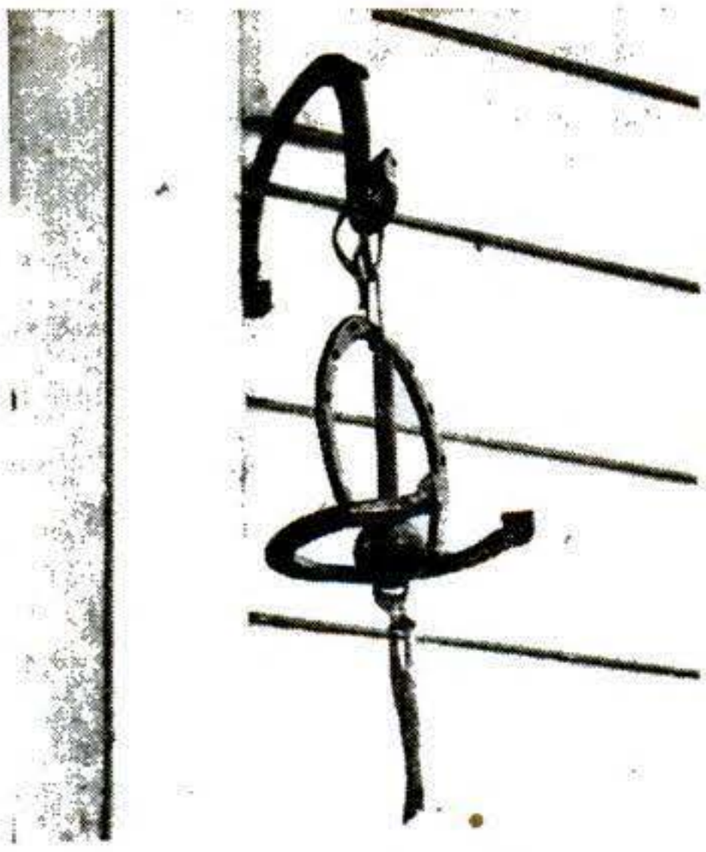
Clanging Horseshoes Announce Visitors

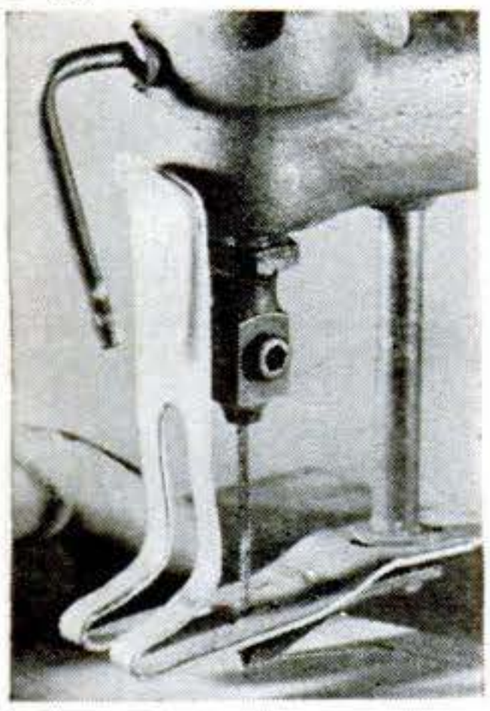
THREE horseshoes form an unusual door chime on the farmhouse of Keith Elwick, of Vinton, Iowa. Two shoes, welded heels to sides, are suspended on a loop of rawhide from a welded eye in a third shoe fastened to the door casing. An iron clapper, also suspended on rawhide, with a pull thong at the bottom, makes the striker.



Tile Flooring Looks Like Wood

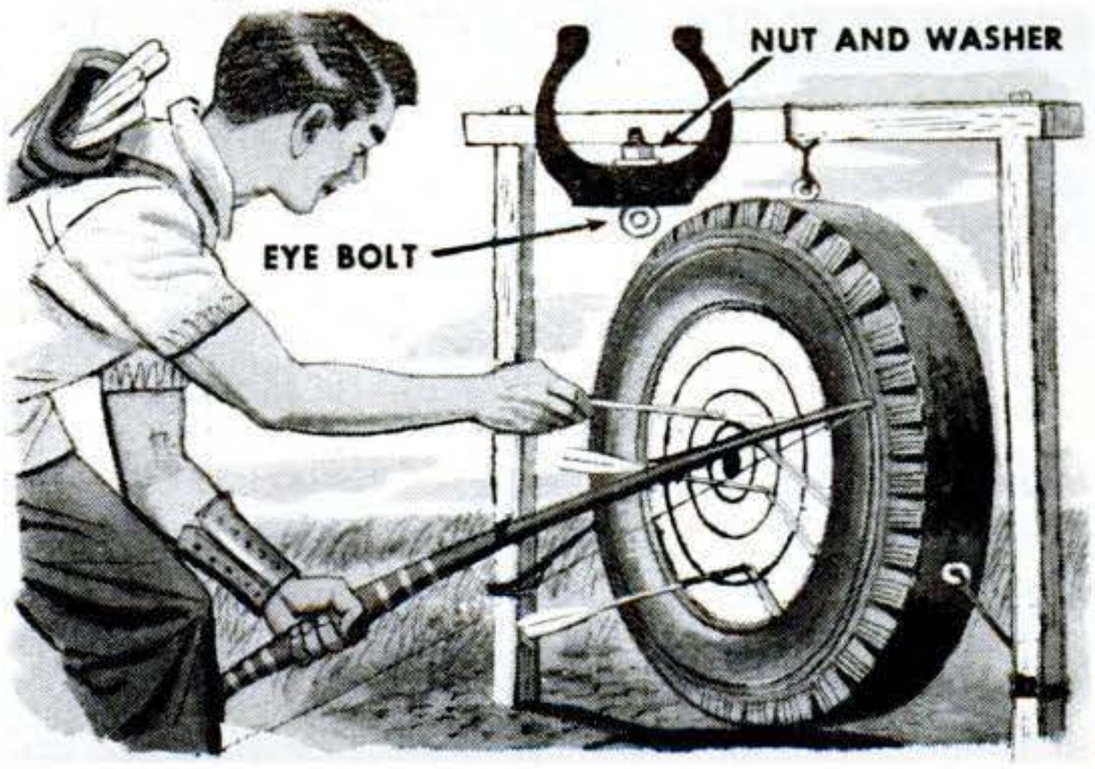
AN ASPHALT-TILE flooring that's grained to look like wood is obtainable from the Mastic Tile Corp. of America, Newburgh, N.Y. The tiles are 9″ by 9″, with straight-line indentations about 1¾″ apart. The tiles can be laid to simulate a parquet floor.

Jigsaw Guard Protects Fingers



FASTENED to the foot support by the foot nut, this guard will keep your fingers away from the blade but still let you see the work. I bent the guide from 16-gauge sheet metal and then dipped it in aluminum paint.—*Dave Botwinik, Kansas City, Mo.*

Archery Target Hung in Tire



AN OLD tire, hung within a frame of poles or two-by-fours, makes an ideal archery target holder. Wires strung through eye bolts in the tire anchor it rigidly to the frame. Targets are easily inserted in the tire and won't be forced out by the wind.—*Victor H. Lamoy, Upper Jay, N.Y.*

Hold It, Whatever It Is . . . with a Telephone Shoulder Pad

BESIDES freeing your hands while telephoning, the V-shaped shoulder rests for phone receivers have a multitude of other uses. Here are three—a handy pipe rest, a nontipping clip for small bottles of cement, glue, or nail polish, and a tool holder. For the last, attach the rest under a shelf in the workshop. Made of rubber, this type of rest is now widely available.—*John J. Rea, Urbana, Ill.*

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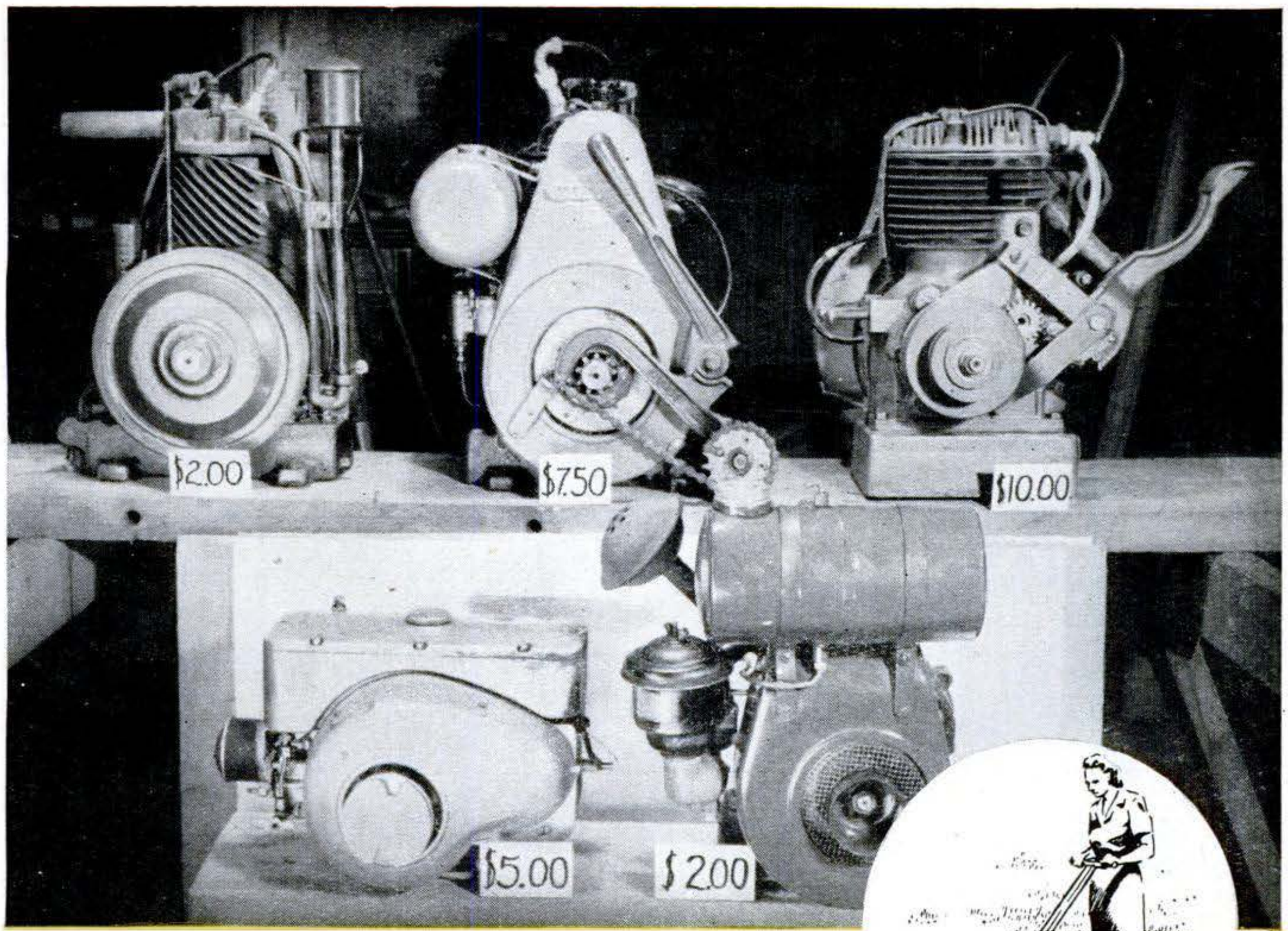
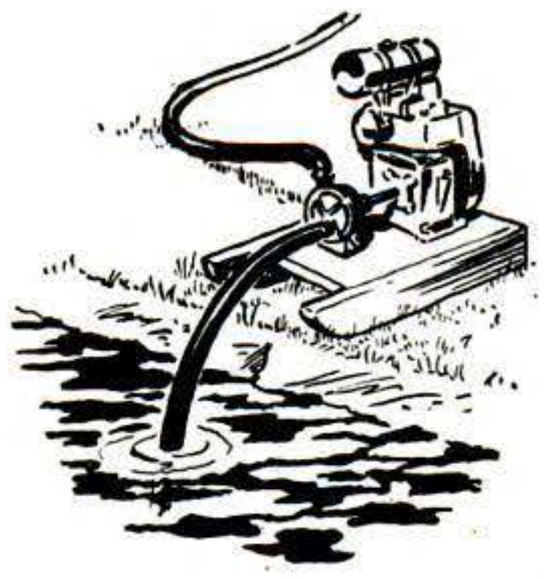


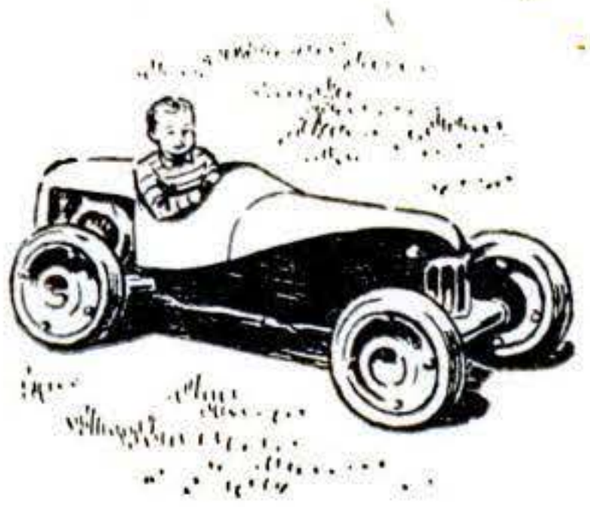
My engines and what they cost me: The old $2 Briggs at upper left—still in good shape although built in 1927—now powers a mower, the $10 four-horse Cushman a garden tractor. The $5 Power Products engine and the two other Briggs models are ready for such jobs as sawing wood, pumping water, powering a car for the children.

One-Lung Bargains Do My Homework

By E. F. Lindsley



You, too, can make a cast-off engine run again. Four pages on how to do it follow.



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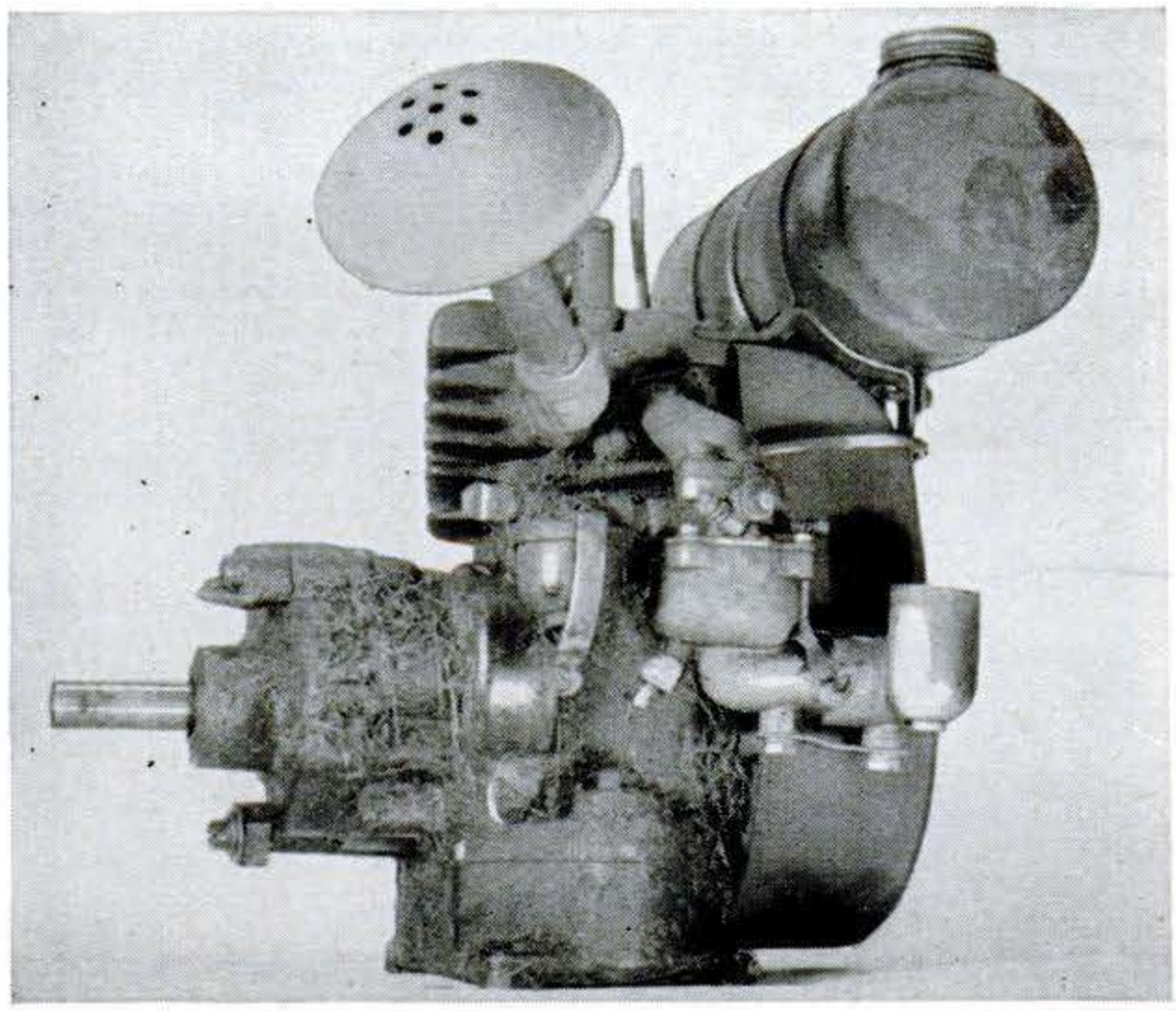
FOR the man who likes to use his brains instead of his brawn, there's no sweeter music than a one-cylinder engine chugging away at a burdensome home or shop chore.

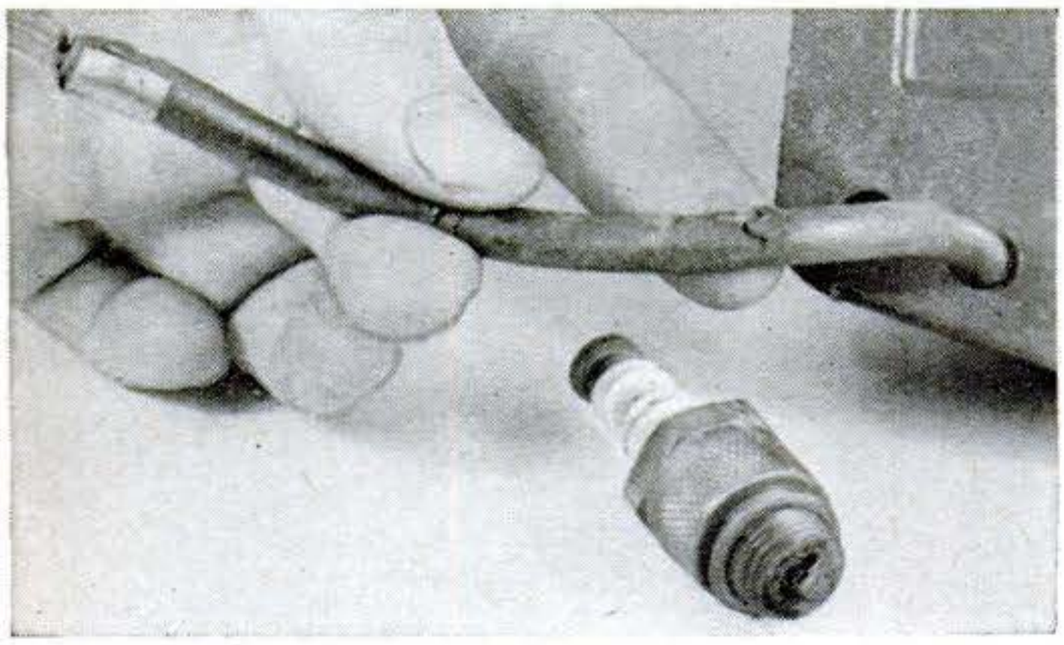
Bought secondhand and overhauled, these little one-lungers can be an inexpensive source of power for a long list of jobs. Wherever you live, it's a safe bet that many are standing idle around your community, gathering dust and awaiting an offer of a few dollars.

Some can be put in working shape with little effort. The original owner of my 1949 Power Products engine sold it in dis-

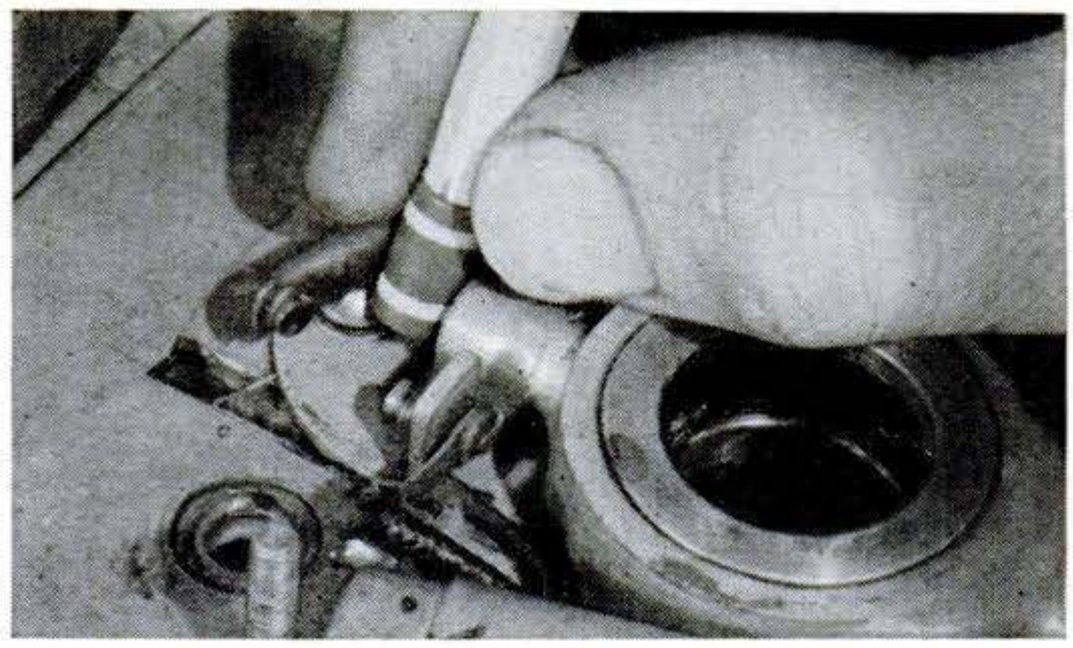
WHY ENGINES WON'T RUN



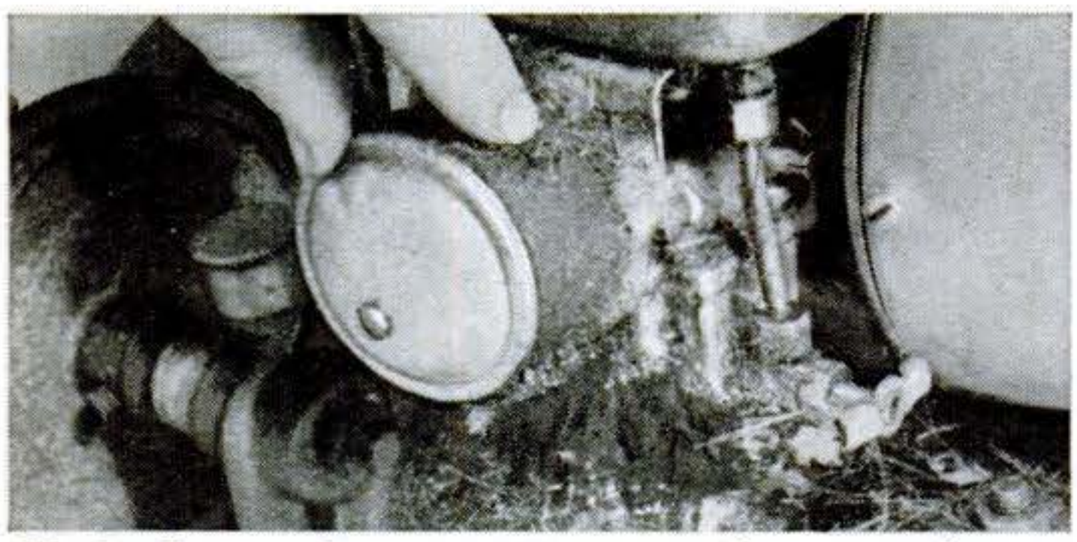
Just plain dirt is often the trouble. The Briggs with integral gear box (at right) never had a chance. It was covered with dirt, its air cleaner was gone, and the fuel filter never had been serviced. The original owner junked it.



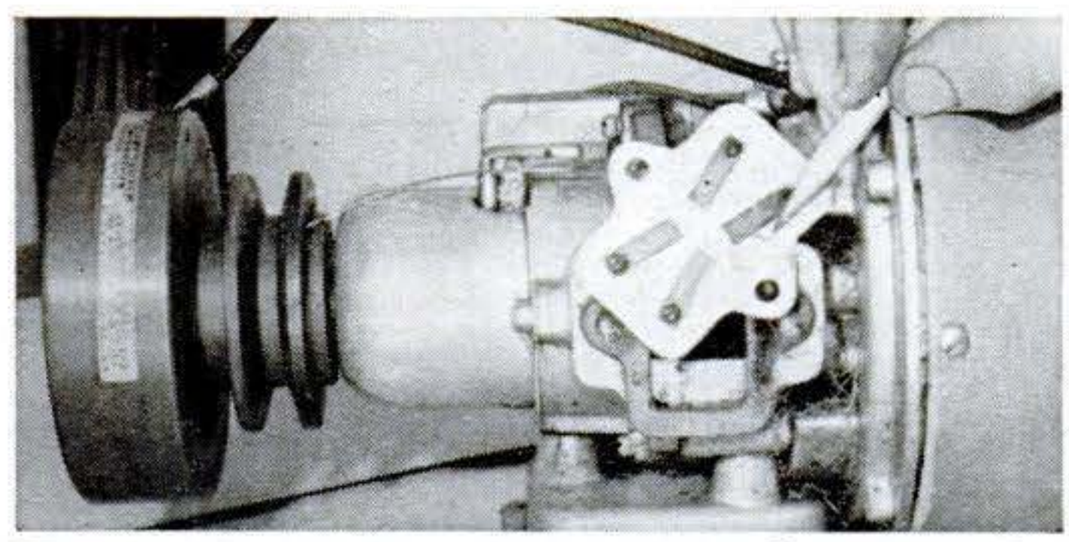
A fouled plug or cracked high-tension lead can cause poor starting, half-hearted performance. Both of these defects are easily remedied.



Burned ignition points. The wrong spark plug may cause this. Auto plug often doesn't have right heat range. Industrial-type plug is best.



Choked air cleaner. Dirt on this one shows how much would have gone into engine if the cleaner hadn't been in place. This engine, my Powers model, won't run if dirt passes through carburetor and jams the delicate reed valves.



Here's what I found. A piece of grass under one valve on the valve plate caused the engine to stall—and the owner to sell it to me. I then fixed it by sealing the air cleaner at the base with mastic calking compound.

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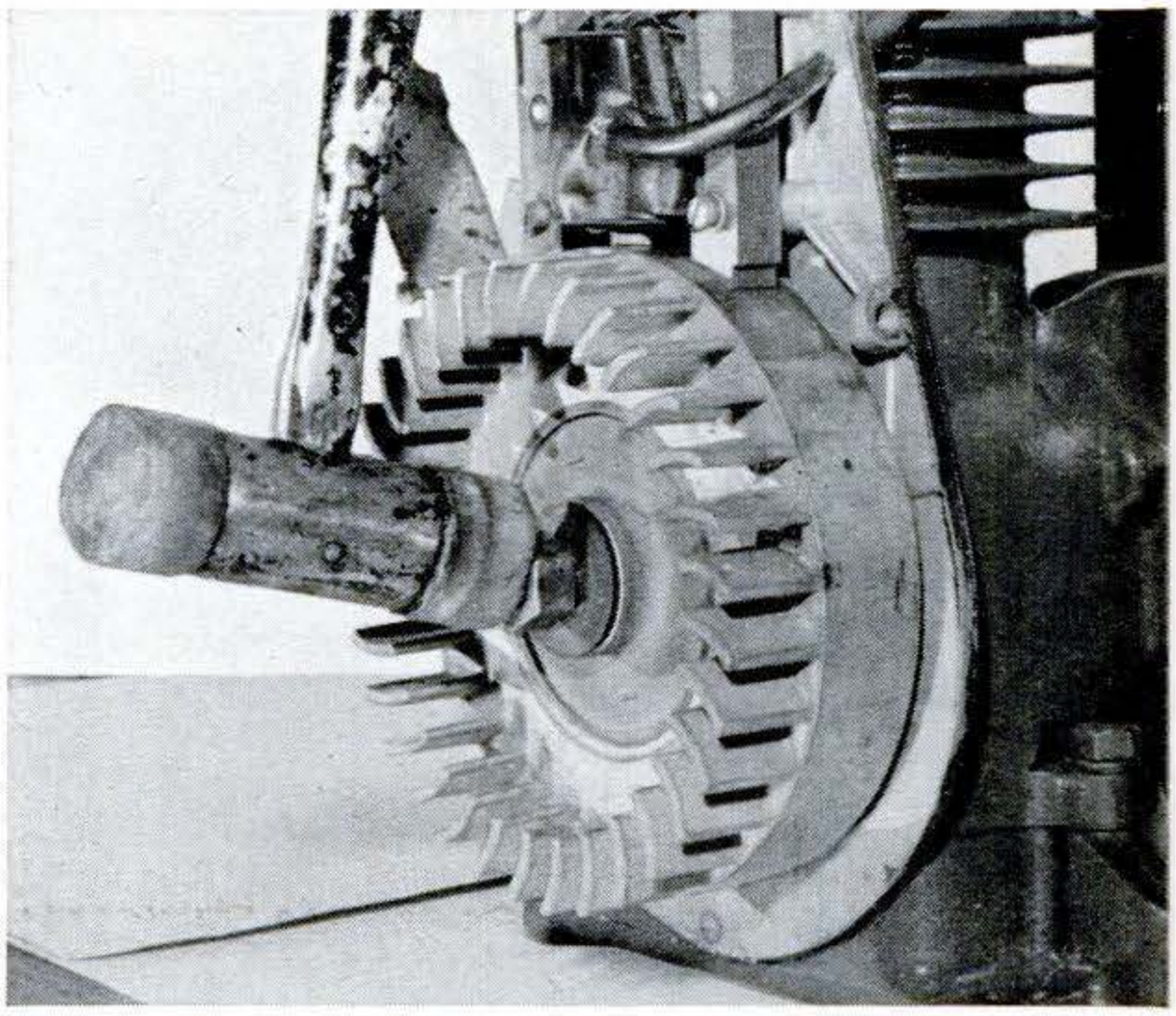
gust when he couldn't start it. Last winter this "no-good" engine hopped off with one pull on the rope while the temperature was below zero. And all I had done was clean dirt from its air cleaner.

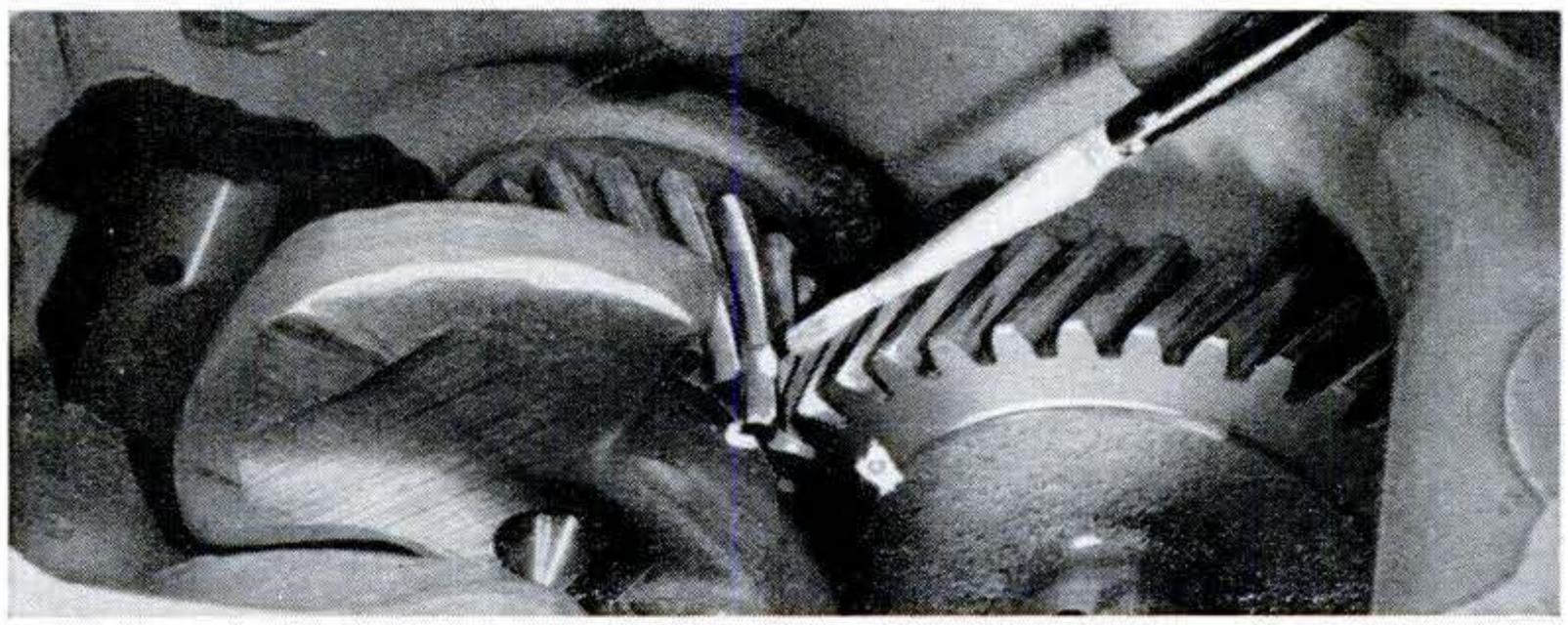
Bargain engines aren't on display. To find them, you have to prowl through basements and peer under workbenches. Some will be junk. But many will be worth a gamble. Once you have located, horse-traded, and lugged one home, the first thing is to determine its make, model, and serial number.

Then go to the nearest dealer and ask to

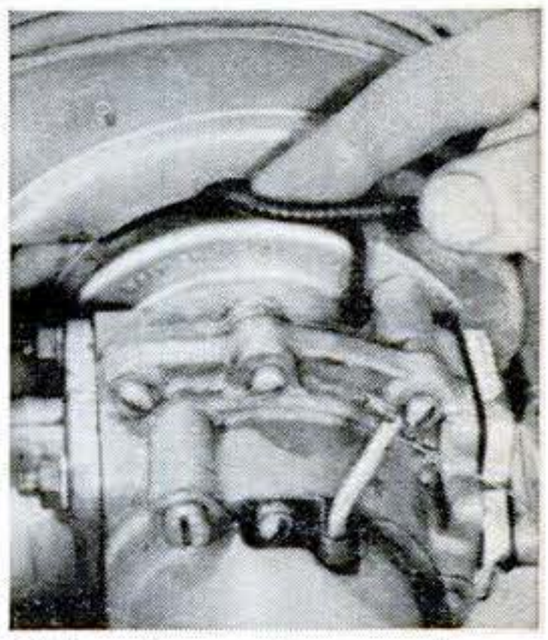
HINTS ON OVERHAUL



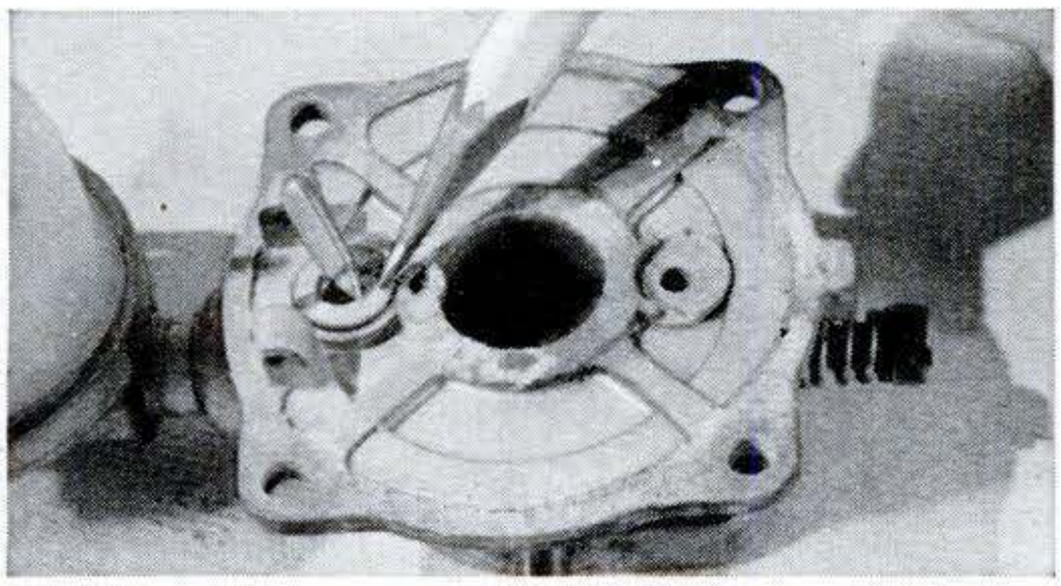
Removing flywheel to reach the magneto may be a tough job. Retaining nut often has left-hand threads. After loosening, leave nut on to protect threads. Strike with soft-faced hammer. Stubborn cases may need gentle heating in hub area with small torch.



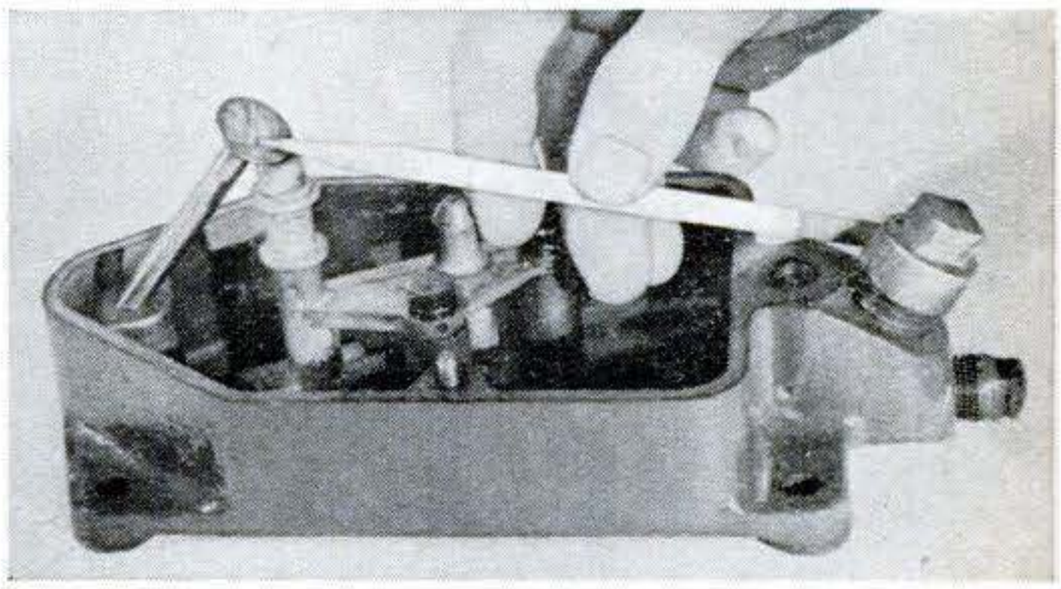
Paint timing marks if original ones are faint or not to be found. If there are no other clues, mesh gears to make intake valve start opening with piston on top center. Time on right slope of cam so intake continues to open and then closes as piston moves down on intake stroke.



Check point where plug lead leaves magneto. Insulation frequently wears there.



Engine vibration limits life of carburetor float needle. This one shows considerable wear. Replacement is usually the best bet.



A badly worn oil-pump plunger should also be replaced. Otherwise, you run a chance of cam damage or costly lubrication failure.

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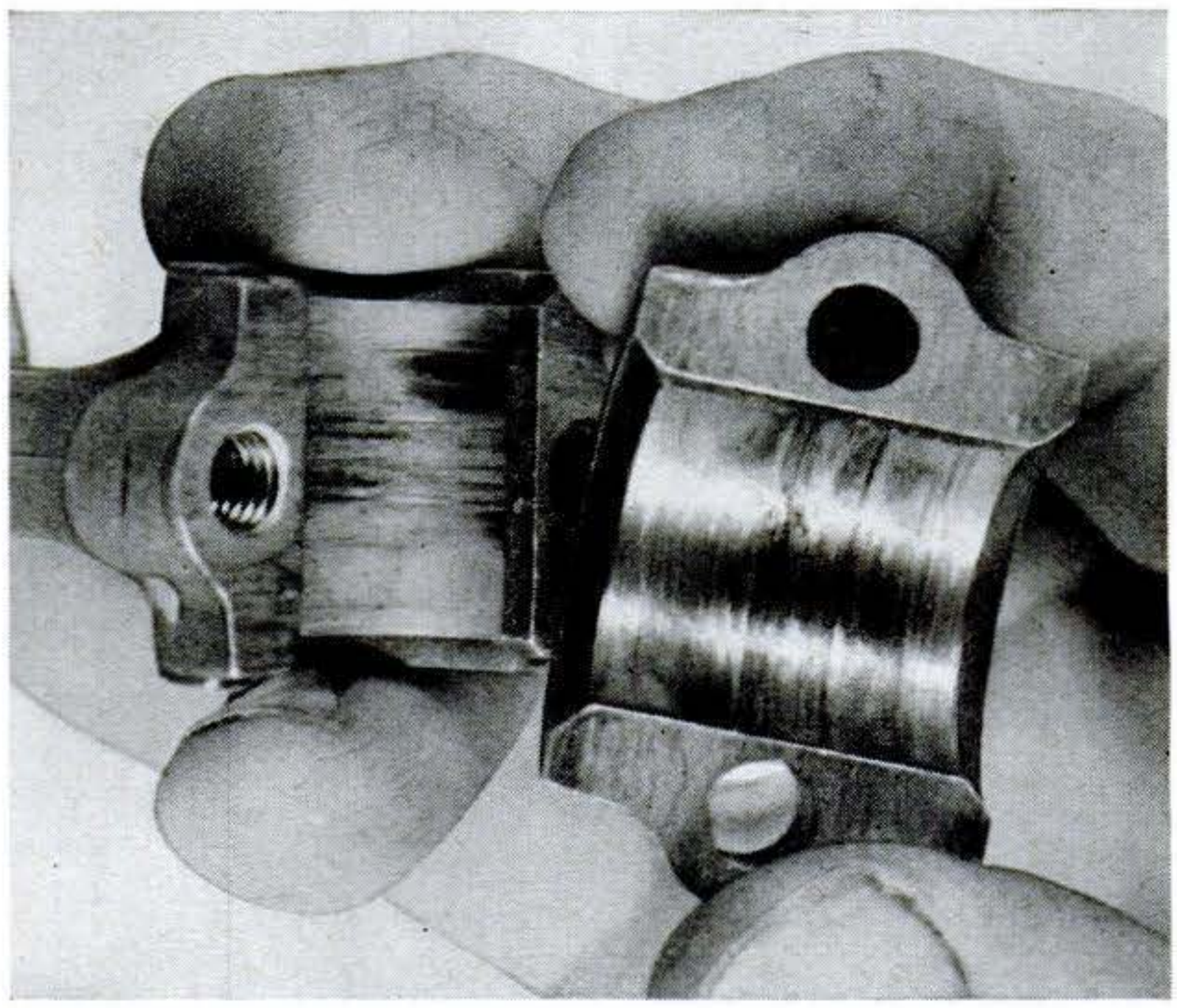
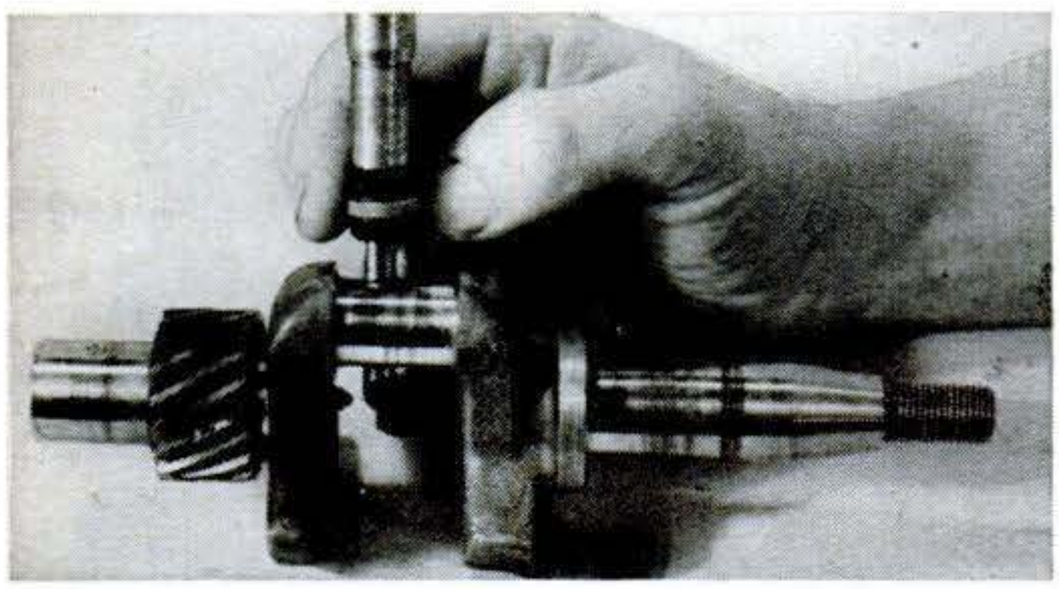
see his instruction book for that model. Also try to get a peek at his service bulletins. As a rule, these are bound in the same volume. A quick reading should tell you what you need to know about any trick features of the engine you've bought.

Pay special attention to what is said about cam timing marks, ignition timing, governor setting, and carburetor float-level adjustment. If possible, note the piston-clearance recommendations. At the same time write down the identifying number of

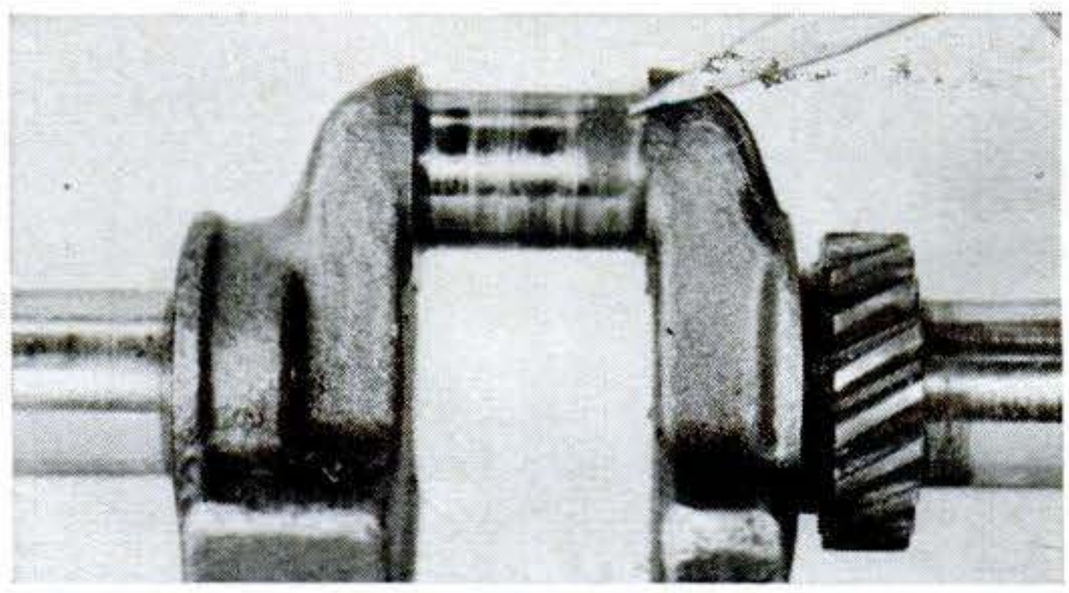
SALVAGING A CON ROD AND CRANKSHAFT



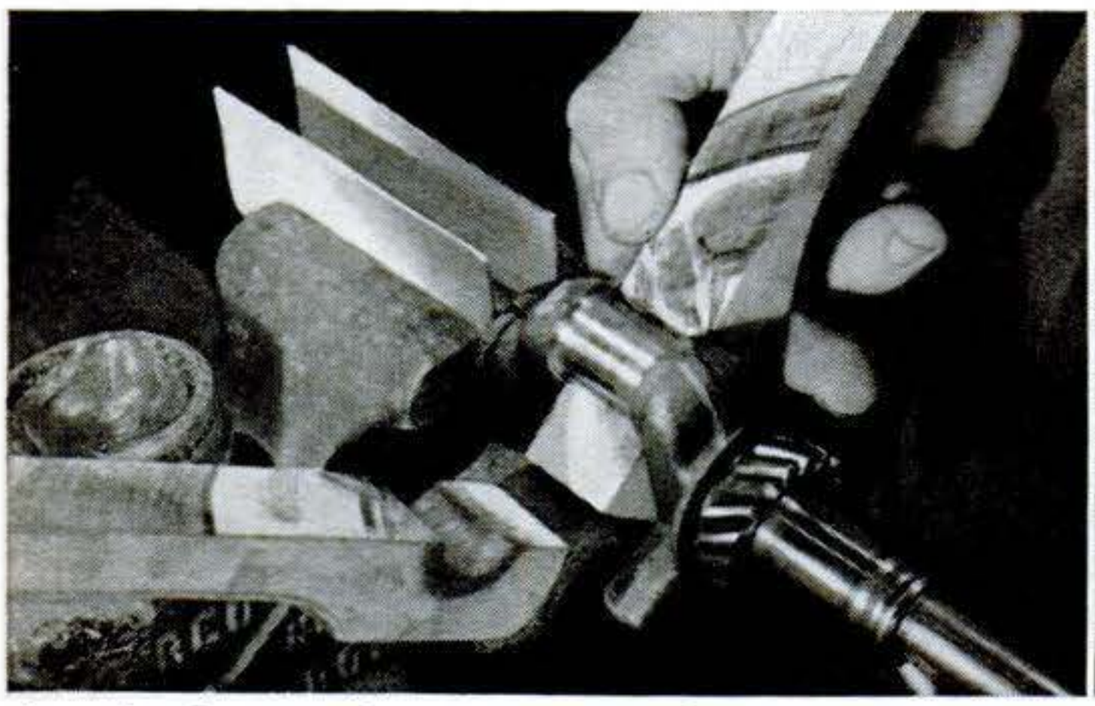
The connecting-rod bearing at right looked pretty bad when I tore down one of my engines. But I decided to see whether the rod, as well as the crankshaft, could be salvaged without resorting to an expensive regrind and buying any new parts.

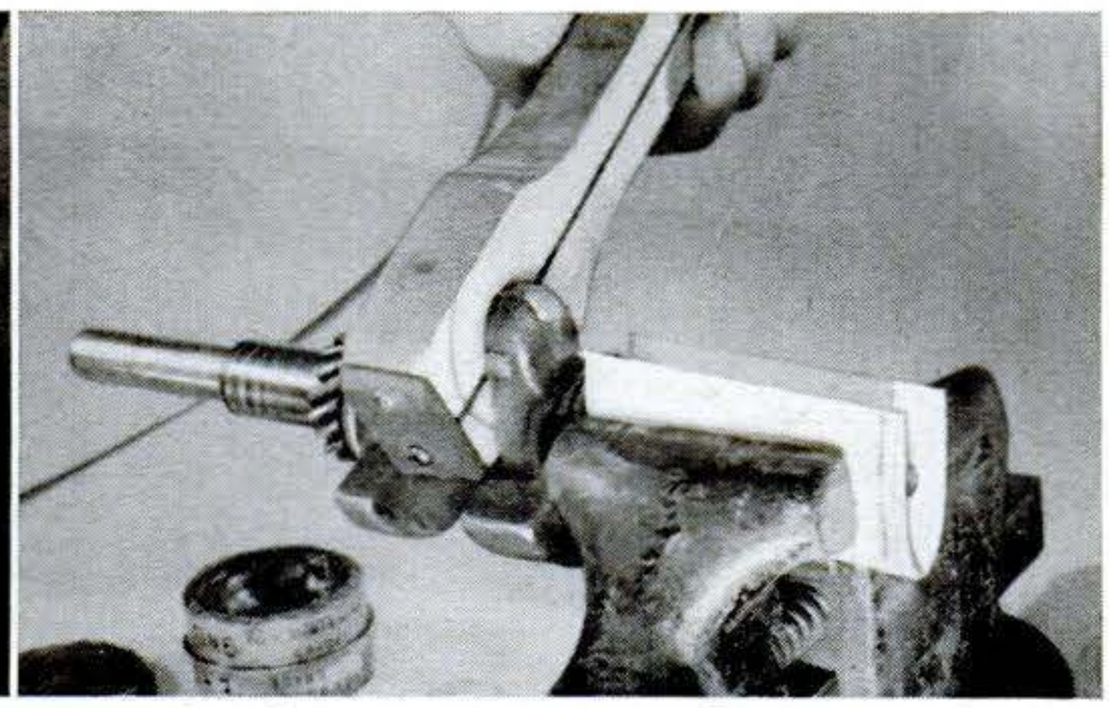


A micrometer check of crankpin showed out-of-round and taper, plus some bad ridges that would have to be removed or dressed down.



Corrosion is another fault you're likely to find on a crankpin. This often results from failure to remove old oil during winter layover.





A split lap of hard maple charged with fine abrasive falls far short of best mechanical practice. But it will dress down a moderately damaged shaft. Make lap solid, bore and ream hole smooth. Then saw it apart and join with leather hinge. Practice on a junk shaft until you have the knack of lapping down high areas without introducing any other troubles.

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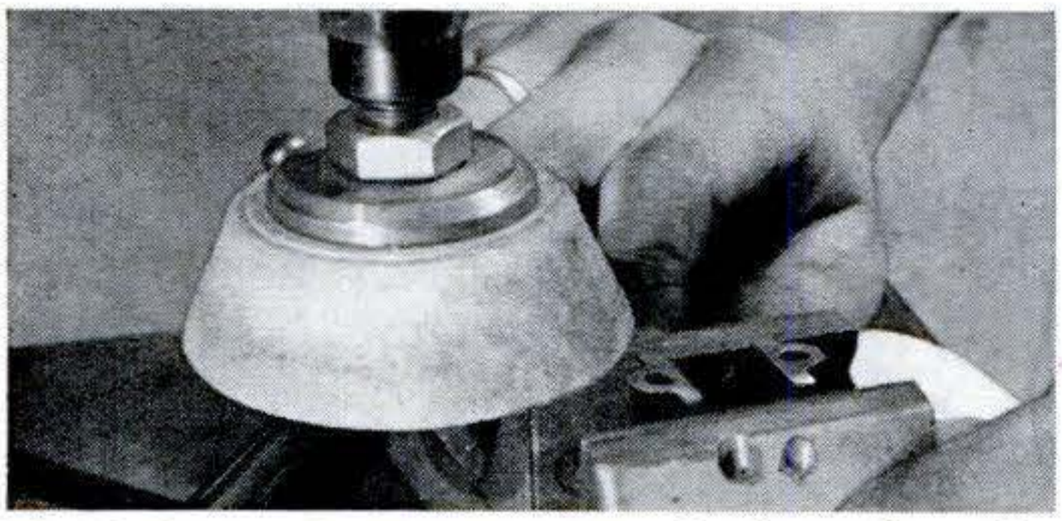
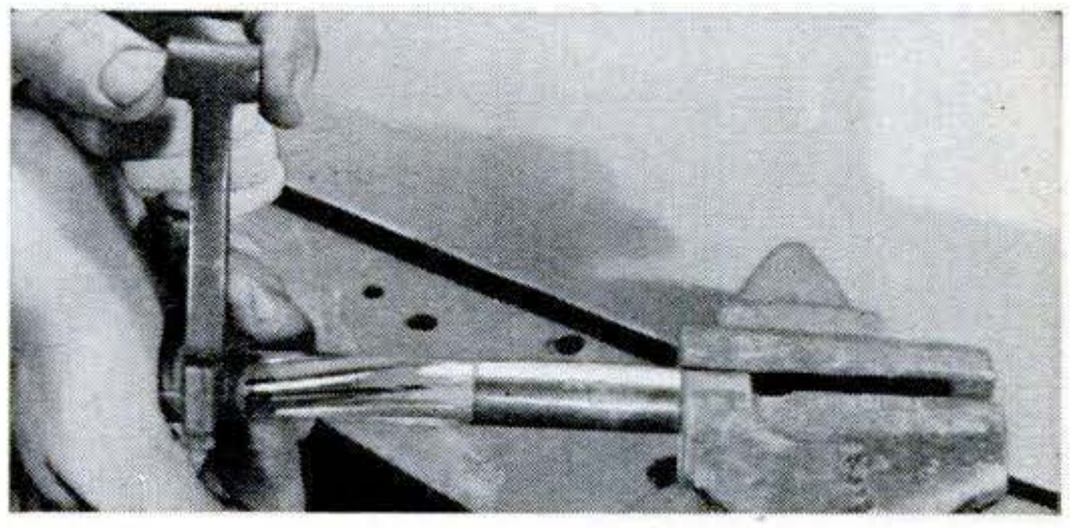
the instruction book. You can then write the manufacturer and request one of your own, if they are still available.

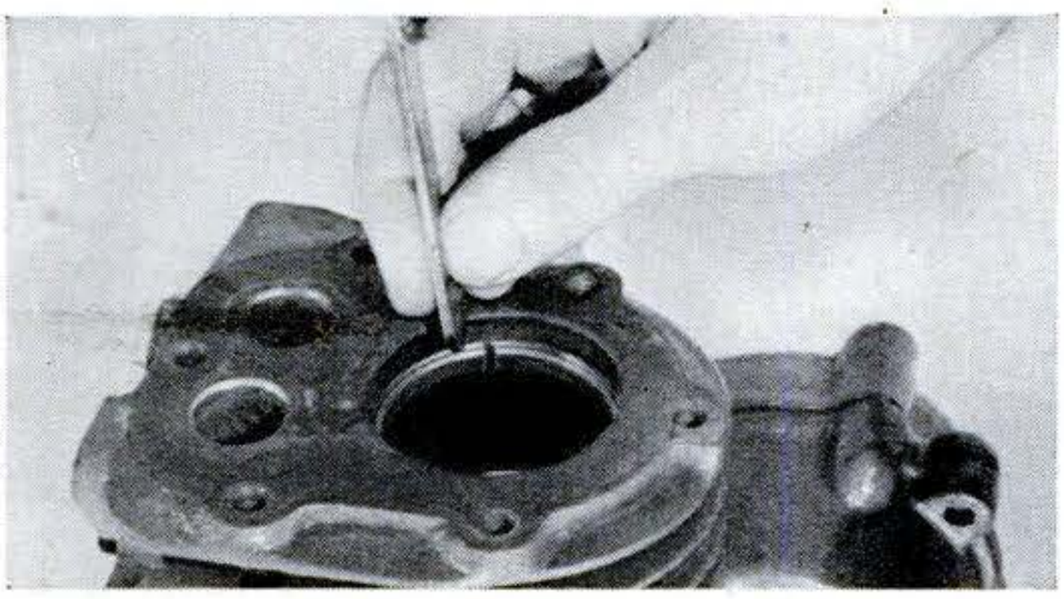
Taking apart and rebuilding one of these little power packages is seldom difficult. But remember to make plenty of identification marks while taking it apart to prevent confusion when you put it back together. Check all valves, breather vents, or drains that remove blow-by and oil vapor and scavenge oil. Be sure that they are clean and work as they should. END



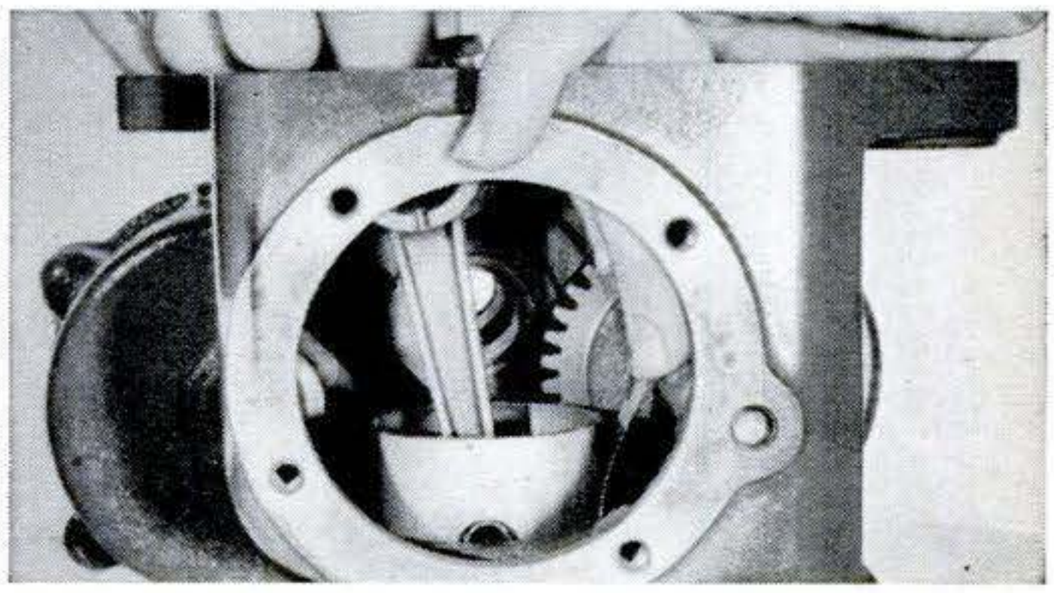
To fit big end of con rod to the lapped crankpin, rod and cap mating surfaces were dressed off on a drill press with this surface-grinder setup. Placing paper under the vise raises cap for successive cuts. Carefully rubbing mating faces on a flat mill file would also do job.



Bearing was reamed out to diameter of the reworked shaft, plus about .001", by clamping a reamer in vise. Make finish cuts after checking tightness of rod bolts. Shims can be used to step up rod clearance. Reaming method can't be used on rods with thin babbit spun in place.



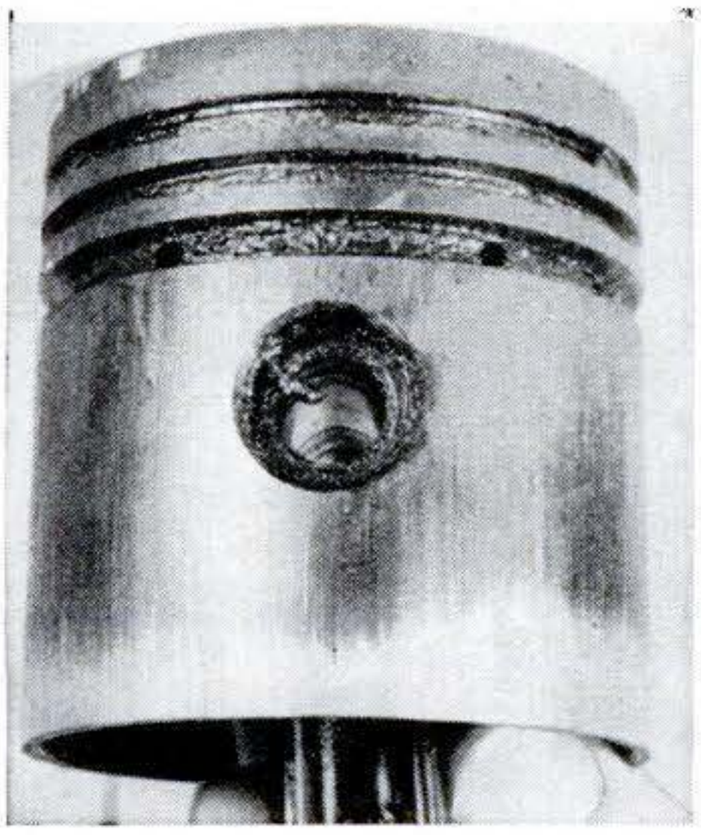
Is rebore needed? For a top-notch job it is in most old engines, but you may be able to get along without it. In this case, a feeler was not needed to show severe ring wear (note big ring gap), but lack of a pronounced ring step at top



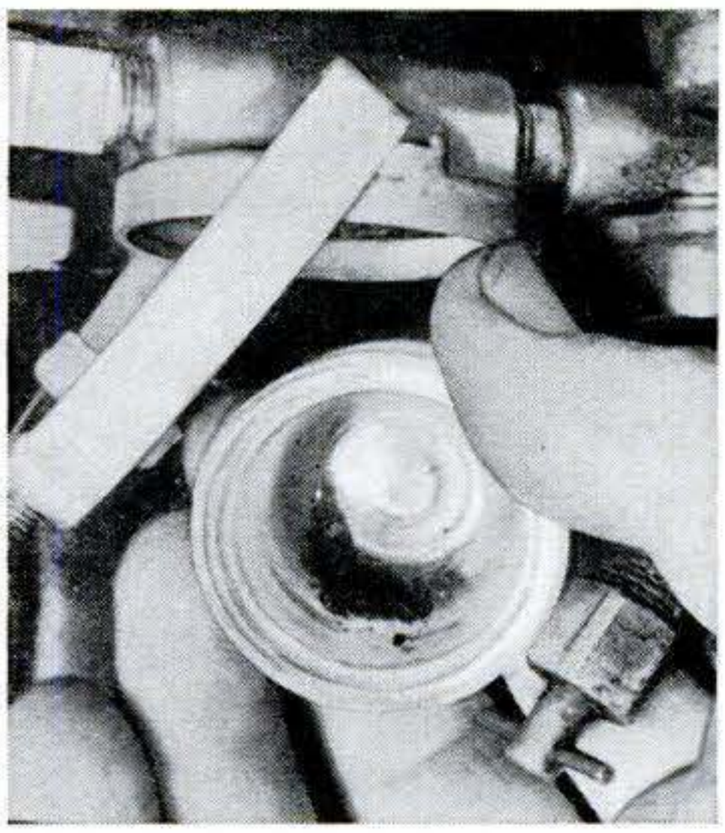
showed cylinder wear wasn't too bad. At right, snug fit of .003" feeler between piston skirt and lower end of cylinder indicates old piston and new rings will serve. Always check cylinder bottom. Wear is least there.

Tips on servicing your engines to keep them in top shape.

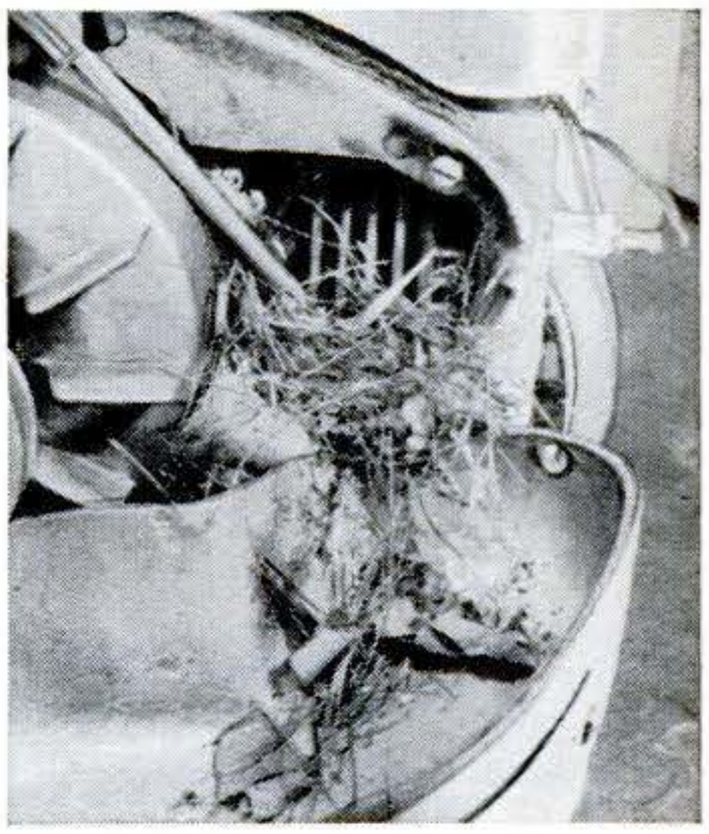
Change oil often and use a good grade. If you don't, you'll help your piston look like this.



Keep filter bowl clean. Flakes and grains of dirt like this are guaranteed to clog carburetor.



Clear grass and leaves from air-cooling system. Never run engine without cover, baffle.



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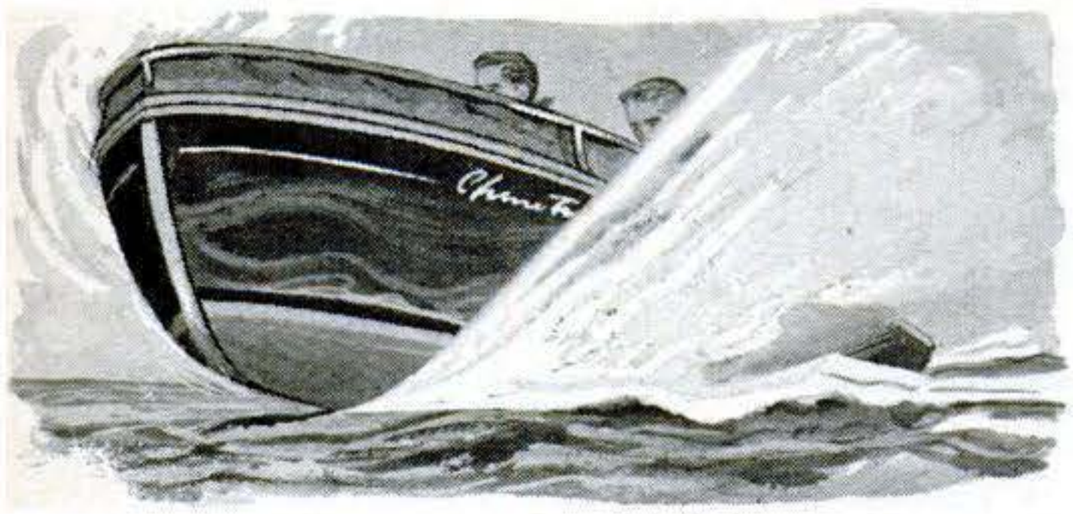
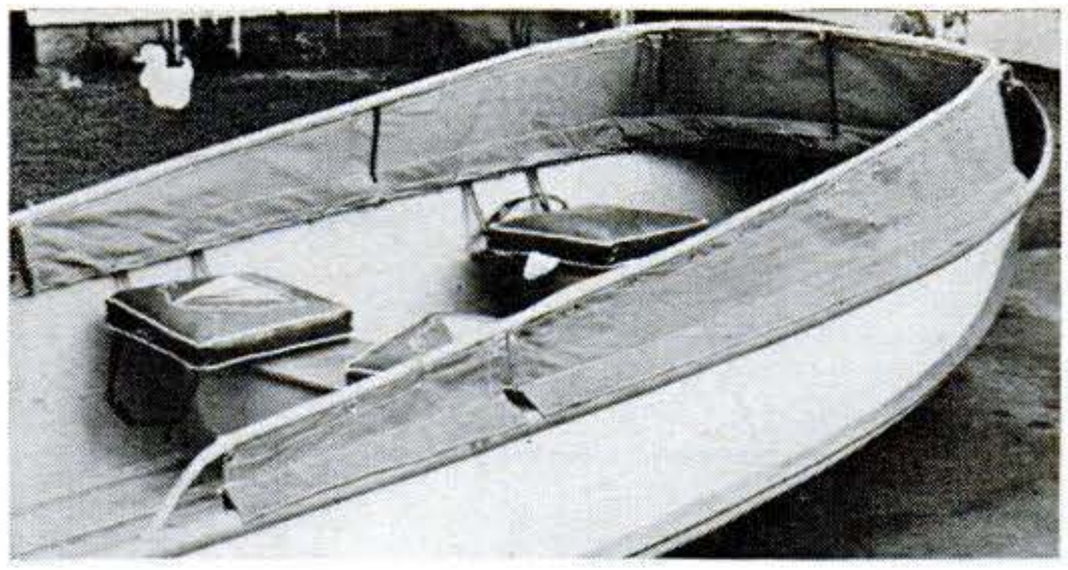
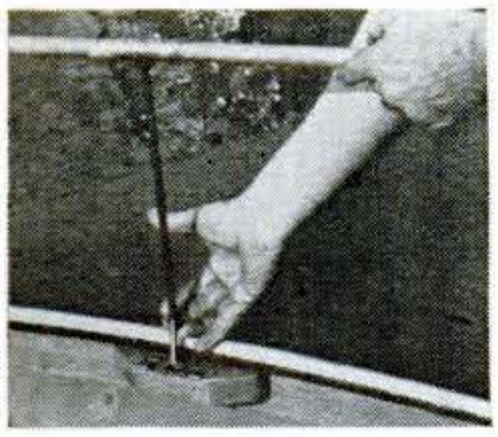
Spray Shield Protects Boat Riders





HERE's all you need to duplicate the spray shield pictured above: Twenty feet of ½″ galvanized steel tubing; about two feet of 5/16″ brass rod; three oarlock sockets; rust-proof grommets; and 10 oz. waterproof canvas.



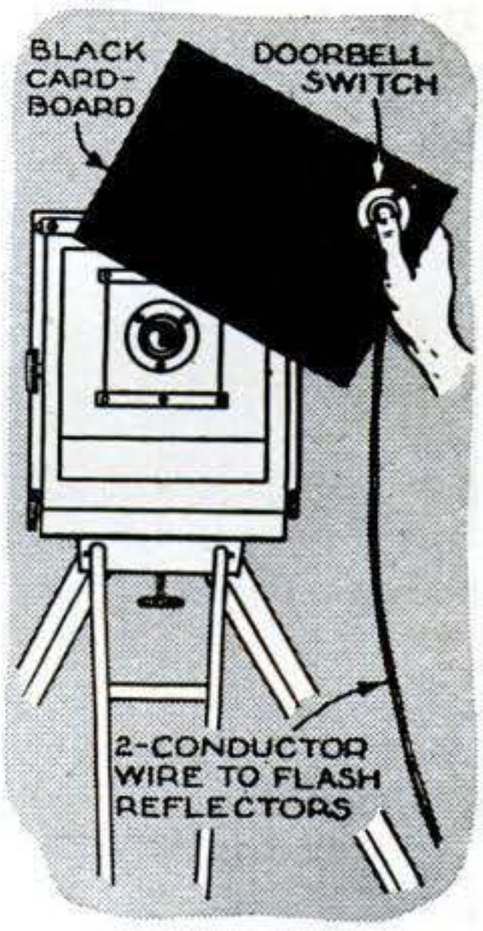
The shield is 10″ high forward, dropping to 5″ aft. Bend the tubing to the inside contour of the gunwales so the shield can be folded inside the boat. Hinge the ends of the tubing inside the rails with No. 14 roundhead galvanized wood screws. Drill the underside of the tubing to take the three 5/16″ brass rods. Lace the canvas to the tubing at the top and through screw eyes on the underside of the rails.—*Clinton R. Hull, Costa Mesa, Calif.*

Test Lights for Low Voltages

THIS low-voltage test light is similar to a standard neon tester except that it operates on AC or DC voltages from 3 to 25. It is made by Industrial Devices, Inc., of Edgewater, N. J., which also makes a second model that has a 6- to 50-volt range. Both types are plastic cased and have spring clips on the leads.

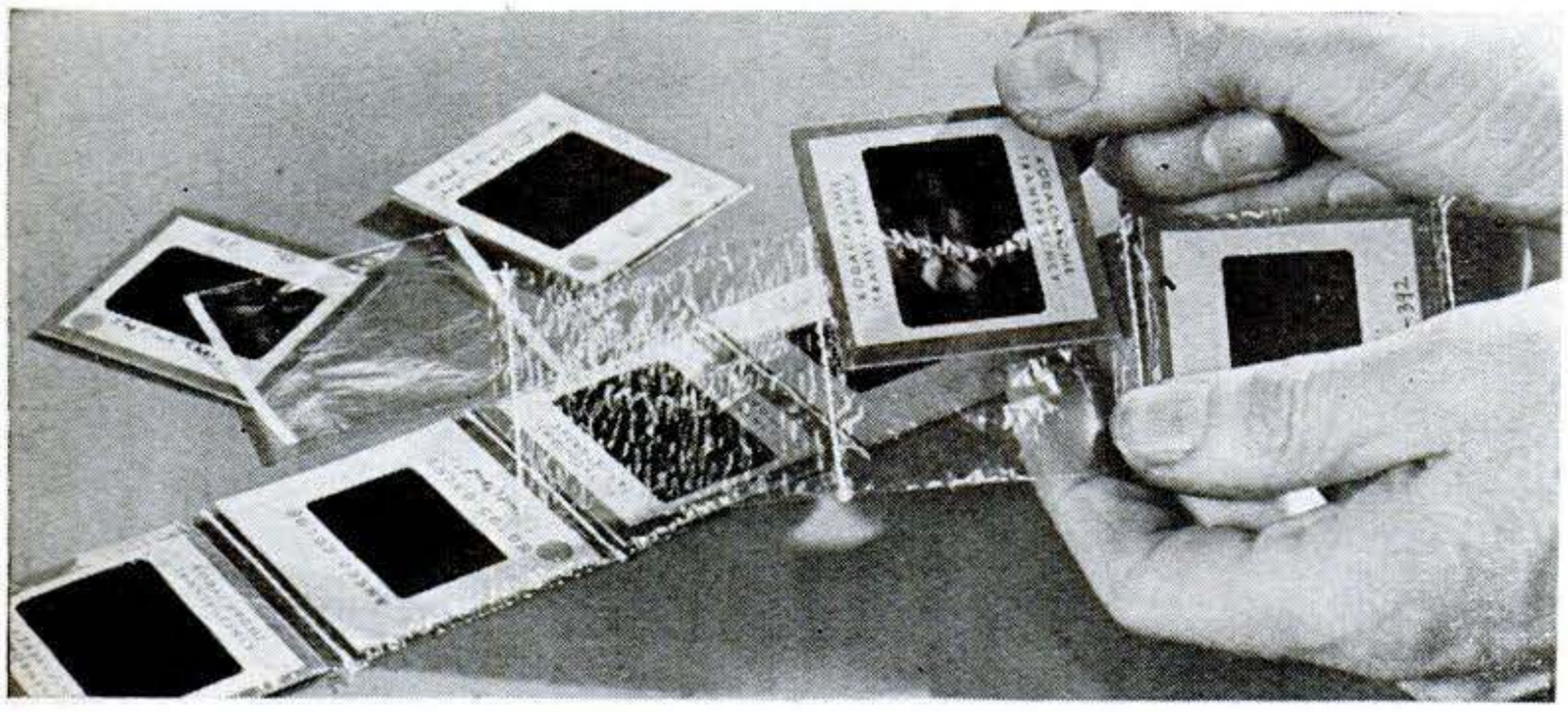
Wave of Hand Makes Open-Flash Photo

HERE's how to make open-flash-shut exposures with a minimum of motions. You uncover the lens and fire the flash bulb with one hand, leaving the other free to remove and return the slide. A piece of two-conductor wire connects the pushbutton switch in series with the flash reflector and batteries. —*A. Trauffer, McClelland, Iowa.*



Chain Made of Cellulose Pockets Protects Color Transparencies

COLOR transparencies can be protected by encasing them in a chain of cellulose pockets. Cut the material slightly more than twice the width of a slide, fold it lengthwise in the middle, and separate it into pockets by stitching crosswise at intervals on a sewing machine. A backing of thin paper, easily torn away later, will help support the cellulose while it's being sewn. Cut a notch in the open edge of each pocket.



Insert the slides and fold the case like an accordion bellows. Each slide can be inspected without removing it from its pocket. — *Walter E. Burton, Akron, Ohio*

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This Booster Is a Specialist

Booster is connected to set and antenna by twin-lead plugs and 300-ohm lead. To disconnect booster, simply pull plugs and join them together. This connects set directly to antenna.

It will give any weak channel a shot in the arm, and you can build it in a couple of evenings for a few dollars.

By Howard G. McEntee

HERE'S a TV booster that you can tailor to your particular needs. It is designed to be adjusted to strengthen signals from one station, and then left alone. It is simple and efficient. Its tube and circuits were chosen to provide moderate amplification with a minimum of noise.

It is tunable over either the high or low band, depending on which set of coils you make. Frequency adjustments are made by movable iron cores in its two tuning coils. You have to wind these coils yourself. Bandswitching is not provided for in these plans because it would add to the complexity and cost and reduce the booster's efficiency.

Laying out the chassis. I built this booster on the steel cover of a 4″ by 5″ by 6″ box. The box supports and protects this chassis-cover. I left the back off to permit air to circulate. Use the kind with the removable 5″ by 6″ panels; the type with the removable 4″ by 6″ sides is not suitable.

Dimensions given on the drawings and photos show the location of critical parts. Drill all the marked holes as specified, stand the remaining parts on the chassis and shift them until they clear the sides of the box, and then mark and drill the rest of the mounting holes.

Making the coils. The coil forms that I used are made by the Cambridge Thermi-

EVERYONE WHO HAS TRIED THIS BOOSTER LIKES IT

ARE you annoyed because one television station you get doesn't come in quite strongly enough for comfortable viewing?

Rotating the antenna helps. But most of the time the pictures on that channel are faint, snowy, and taunting.

The author of this article designed and built a booster to improve his reception of telecasts on Channel 13—and succeeded. Friends tried his prescription on other channels and on several makes of receivers—and were delighted. Maybe it will help you, too.

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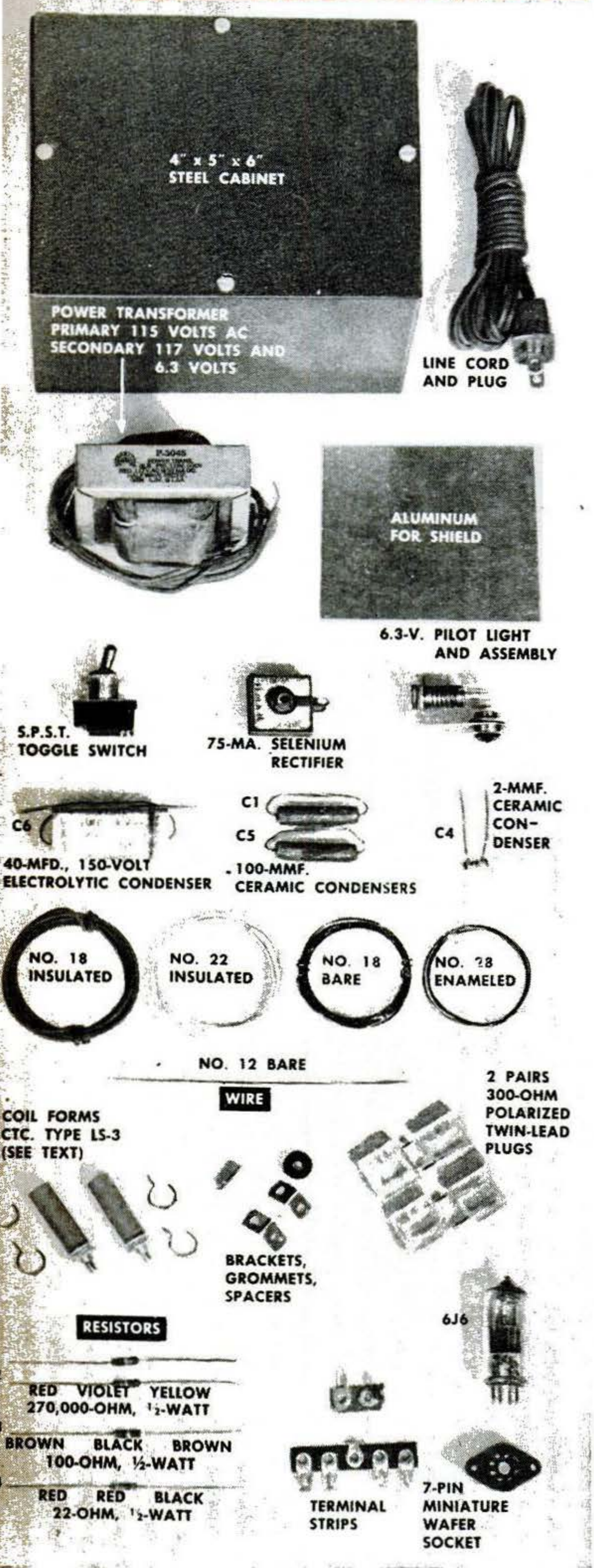
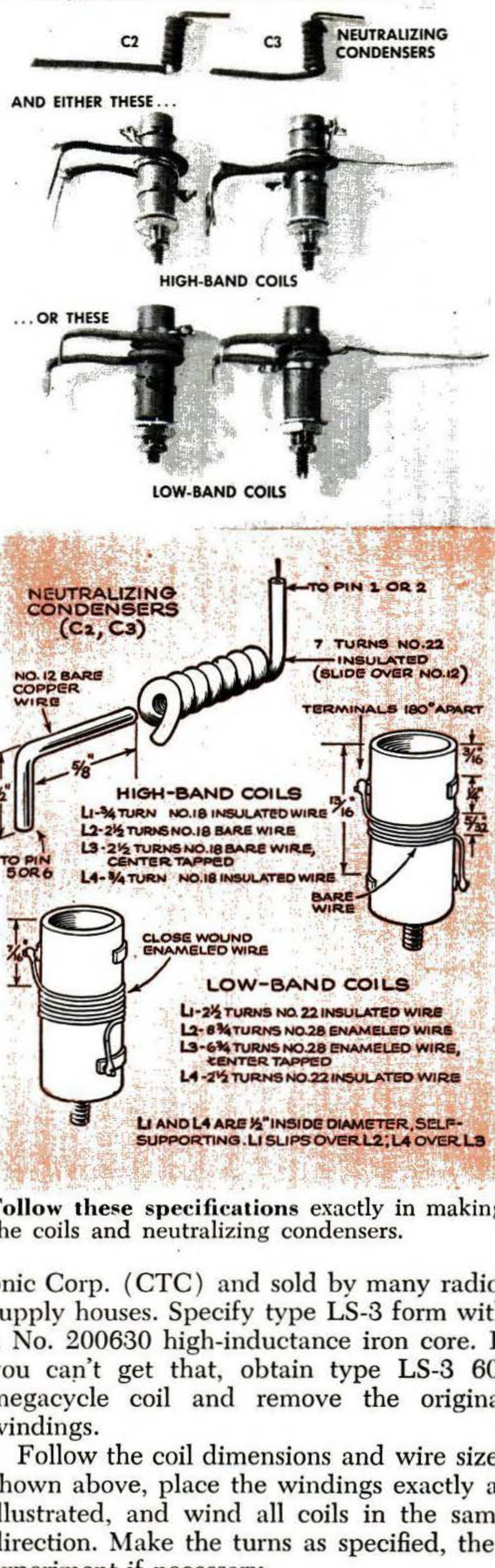
YOU BUY THESE PARTS



These parts cost me $11.77 at standard retail prices. I had to shop around for some of them. If you have some items on hand, your booster may cost you less.

...AND MAKE THESE



Follow these specifications exactly in making the coils and neutralizing condensers.

onic Corp. (CTC) and sold by many radio-supply houses. Specify type LS-3 form with a No. 200630 high-inductance iron core. If you can't get that, obtain type LS-3 60-megacycle coil and remove the original windings.

Follow the coil dimensions and wire sizes shown above, place the windings exactly as illustrated, and wind all coils in the same direction. Make the turns as specified, then experiment if necessary.

To keep the wire taut while winding the coils, solder one end of the wire to one of the clips on the form. Then clamp the other

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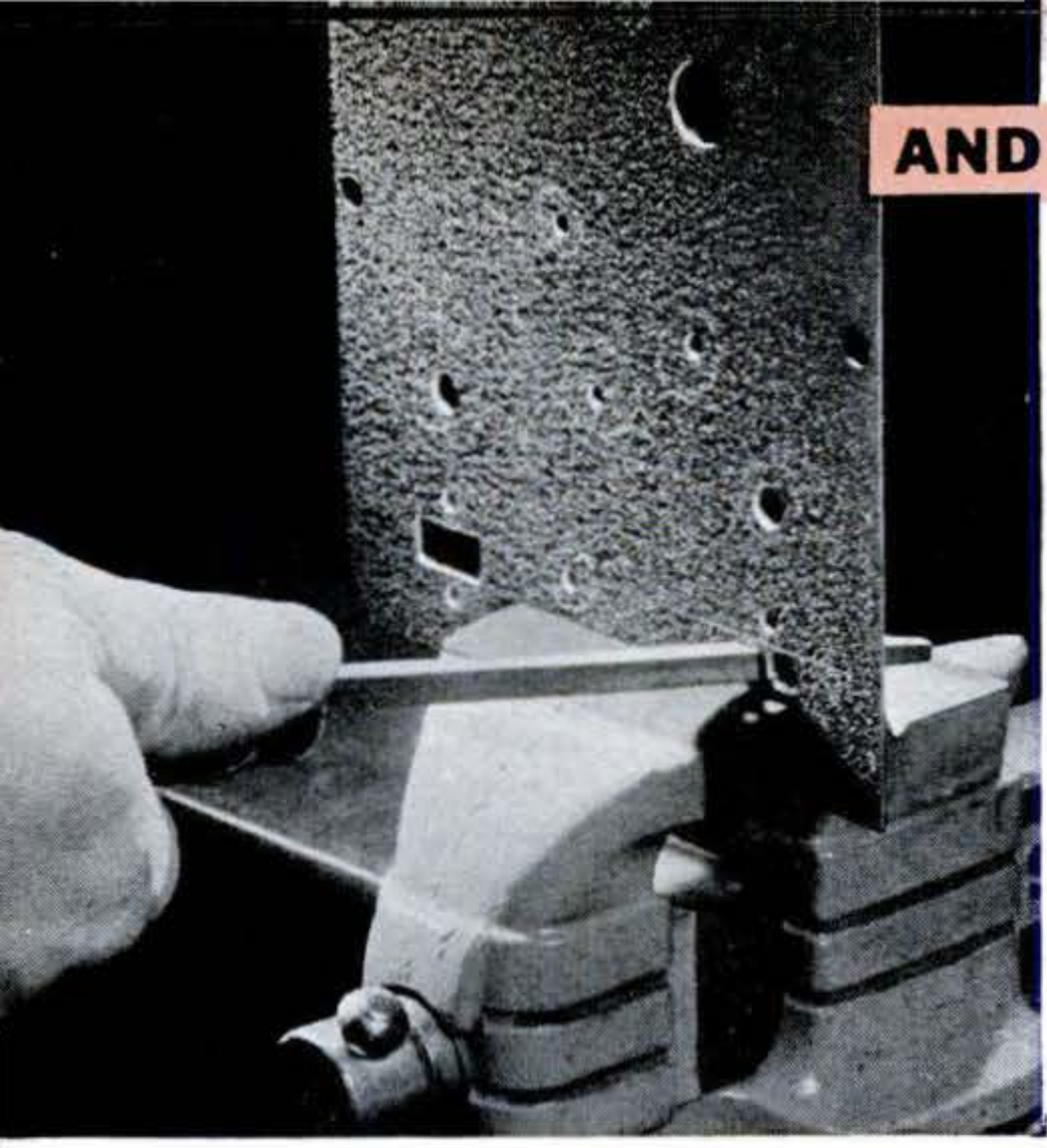
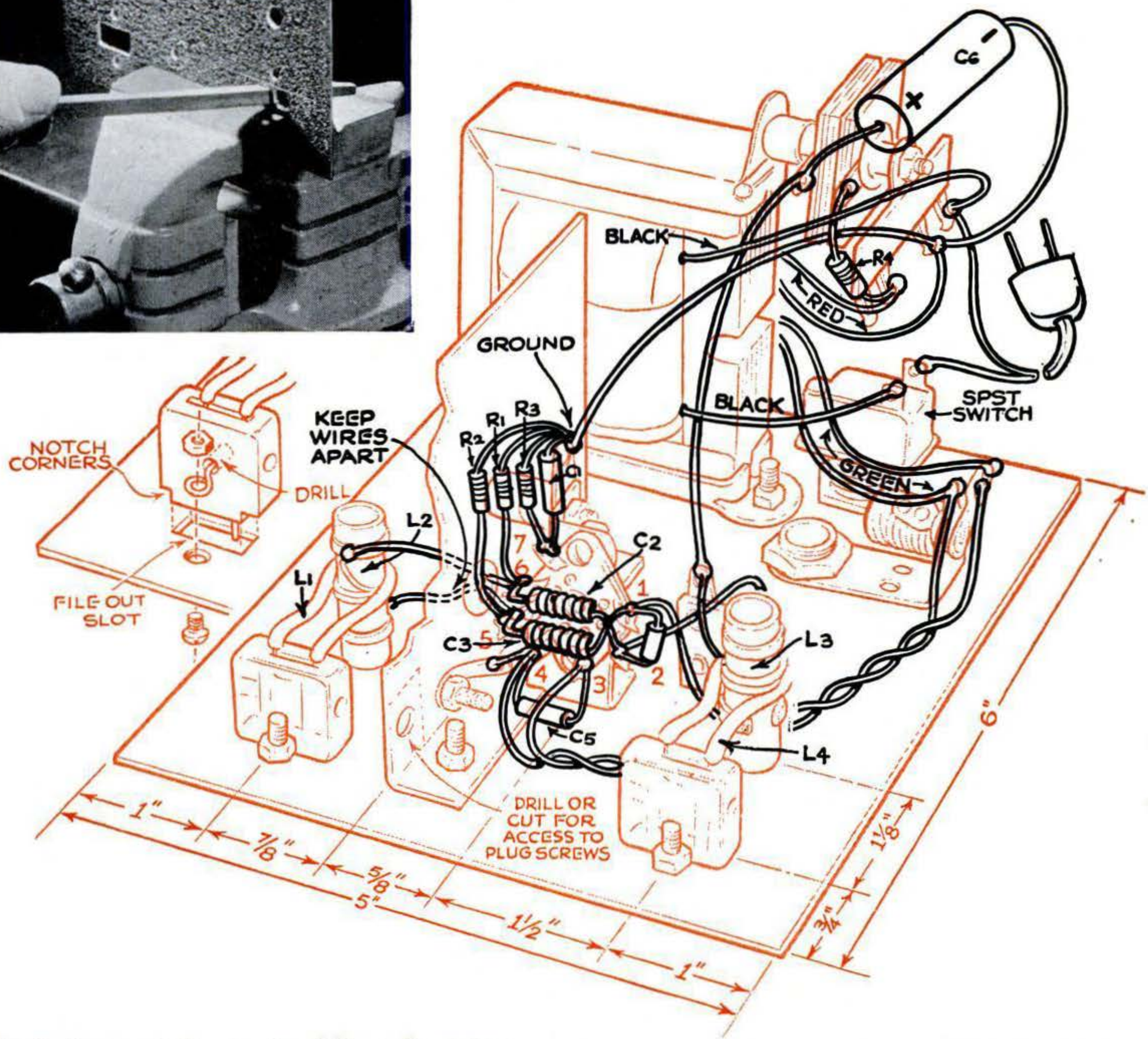


AND MOUNT PARTS ON PANEL THIS WAY

To make mounting holes for the 300-ohm antenna-lead plugs, drill two 5/16" holes side by side for each and file them out to get rectangular slots. File off corners of plugs and fasten them with wire saddles as shown below.

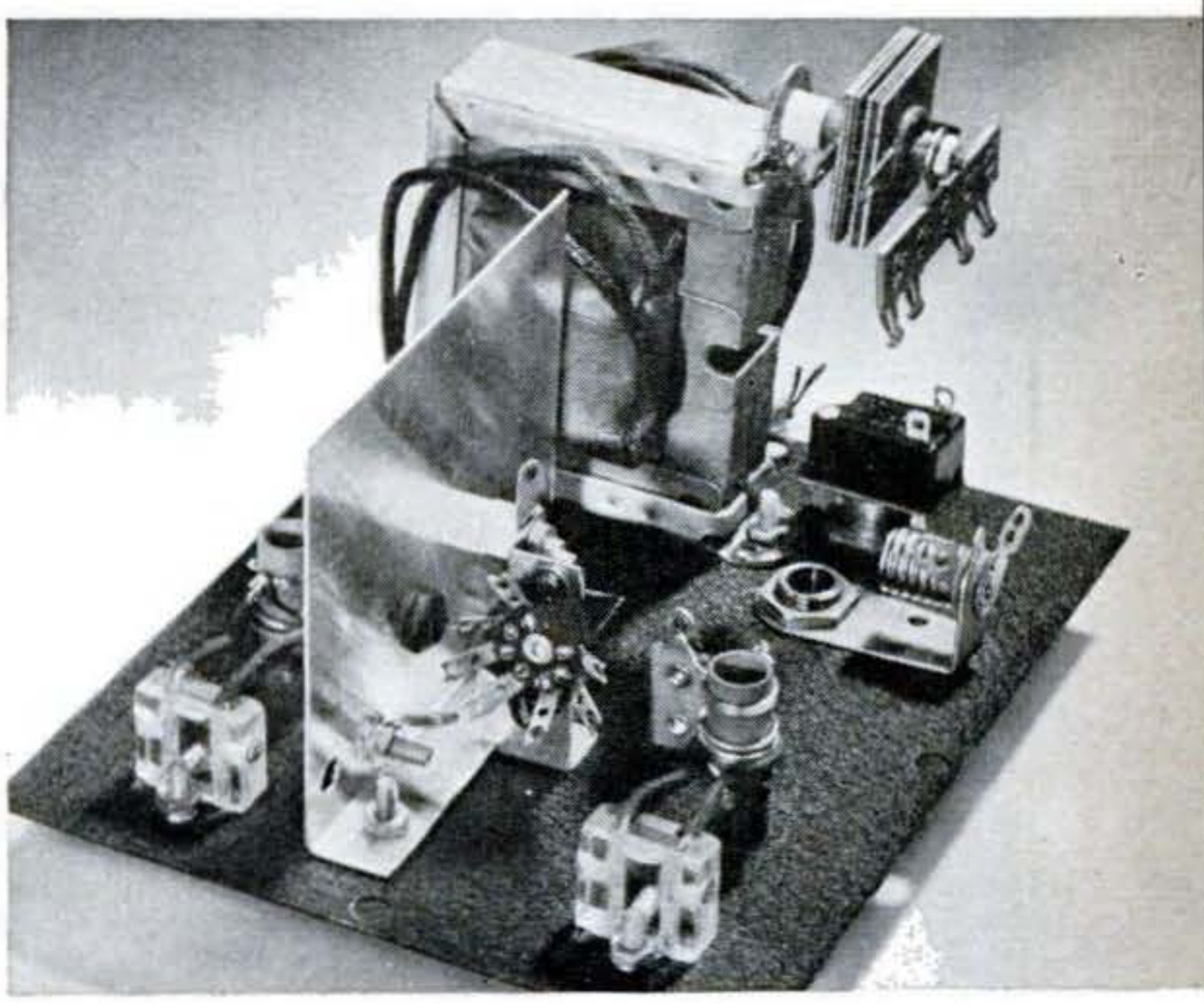


In laying out the parts, follow dimensions wherever they are given. You can wire the booster from this sketch or use the schematic diagram on the following page.

end of the wire in a vise and wind the coil toward it. After you have the required number of turns, solder the wire to the second clip and cut off the excess wire. Apply a bit of coil dope or cellulose cement to keep the turns in place.

To make the low-frequency plate coil (for channels 2 to 6), wind just under 3½ turns, make a ¼" loop in the wire for a tap, twist it a few times, then continue with the other half of the winding.

To make high-band coils (for channels 7 to 13), place the connection clips 180° apart, then wind 2½ turns. The plate coil



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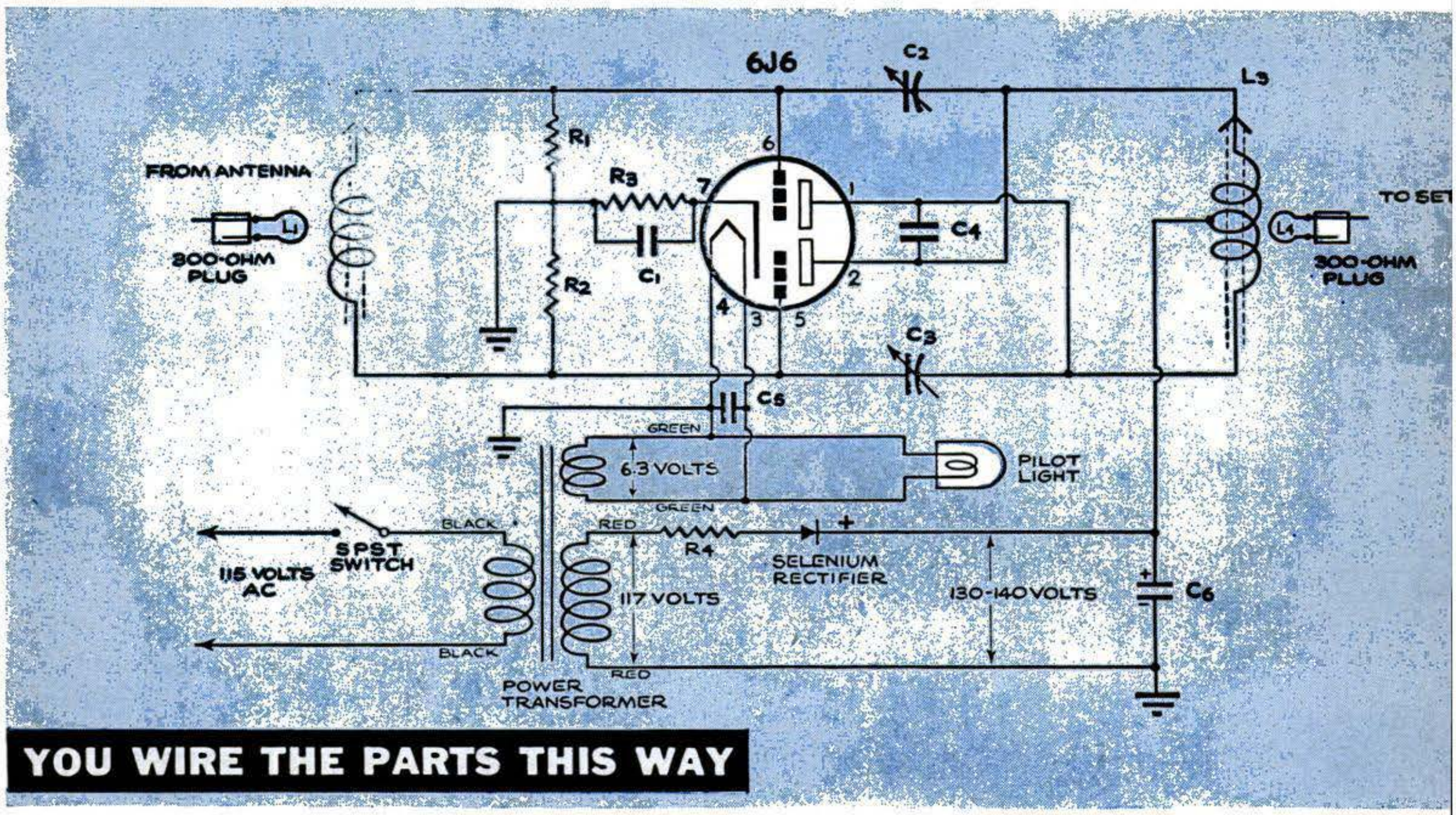

YOU WIRE THE PARTS THIS WAY

Even if you work from the pictorial diagram on the preceding page you should check the connections in your booster against the schematic before you plug it into an AC outlet.

for the high band uses heavier wire and fewer turns, so you should be able to wind the entire coil in one operation and solder the tap exactly in the middle. No tap is needed in the grid coil for either band.

The coupling coils are self-supporting and are held by the screws in the twin-lead connectors.

Buying the parts: The transformer is a type that has only recently become popular. I used a Merit type P 3045. Other manufacturers make very similar units.

I tried to buy a 50-milliampere selenium rectifier but couldn't, so I settled for a larger 75-ma. unit. In some localities you may be able to purchase a 2.2-mmf. ceramic capacitor (C4) more easily than the 2-mmf. condenser shown. You can use either one. The same is true of 250,000-ohm as against 270,000-ohm resistors (R1 and R2).

Mounting the parts: The coil forms have threaded necks that fit into ¼" holes in the chassis and are fastened by lock screws on the outside. The tube socket is held by a couple of metal brackets, one attached to the chassis and the other to the aluminum shield that cuts the chassis in half.

Most of the other parts are fastened with short 6-32 machine screws and nuts.

Wiring the booster: Start by wiring the transformer, switch, rectifier, and power supply. Go next to the pilot light and tube filament, and then proceed with the remaining tube-socket connections. Leave the neutralizing condensers for the last.

Keep all leads as short as possible. If a wire can't be kept short, lead it near the chassis and keep it away from the edge. Check all bare wires carefully to make sure they aren't touching other parts or the chassis in the wrong places.

I collected most of the ground connections at two points. One is a lug on the 4-terminal strip bolted to the rectifier, the other a solder lug on the aluminum shield. I then wired the two lugs together.

Adjusting the booster: When you have double-checked every connection, plug in the booster. Before you turn it on, tune your receiver to a weak channel. Switch on the unit and connect the input side to your antenna and the output to the set. Label these on the box.

The four adjustment points are the two neutralizing condensers and the movable slugs in the tuning coils. Set the coil cores so they both project about ½" on the panel. Examine the screen for odd, wavy patterns and listen for a hissing sound in the speaker. They indicate oscillation. The neutralizing condensers must be adjusted to cancel it out.

To adjust the condensers, use a plastic "neutralizing tool" or a sliver of dry wood.

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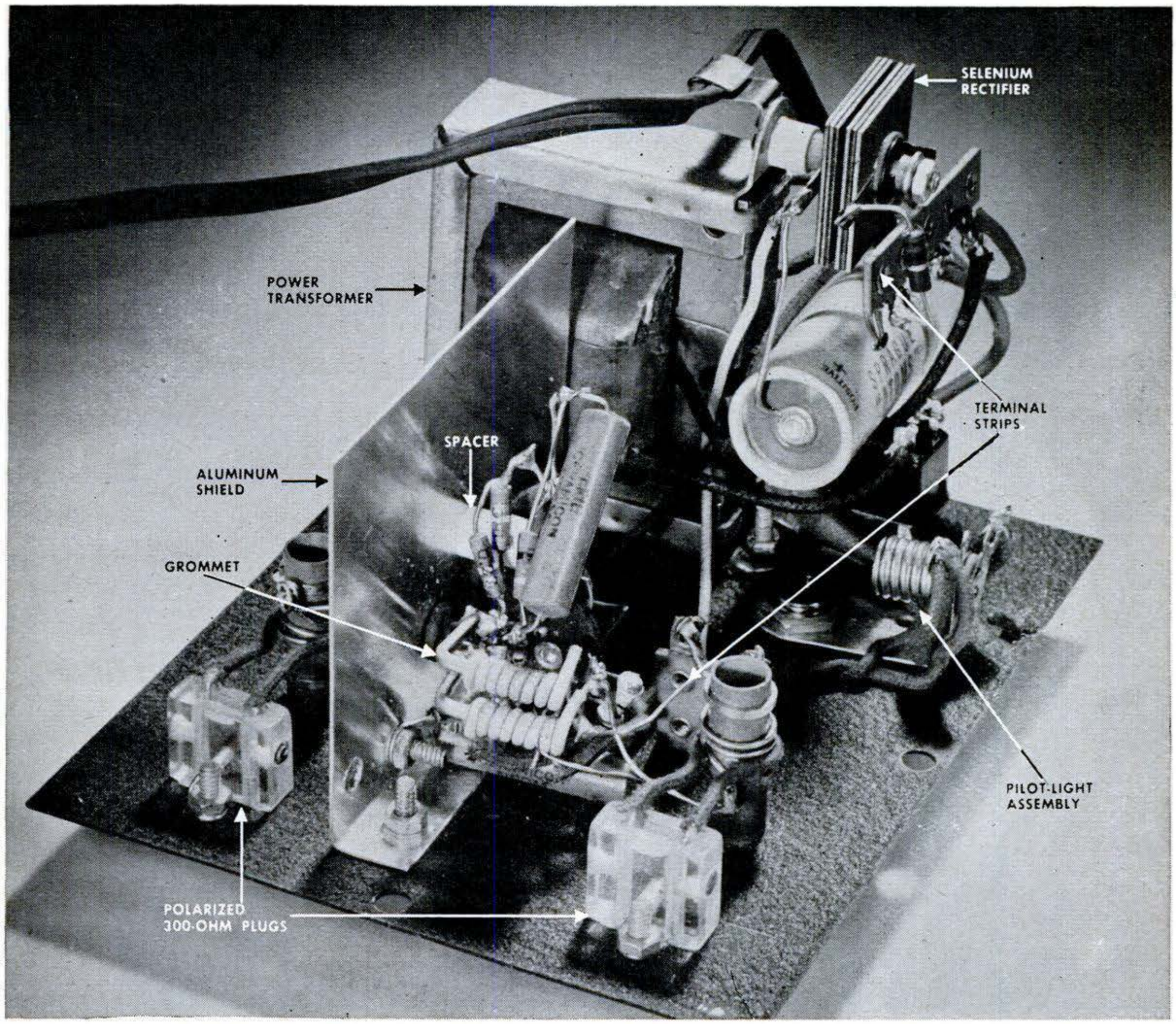
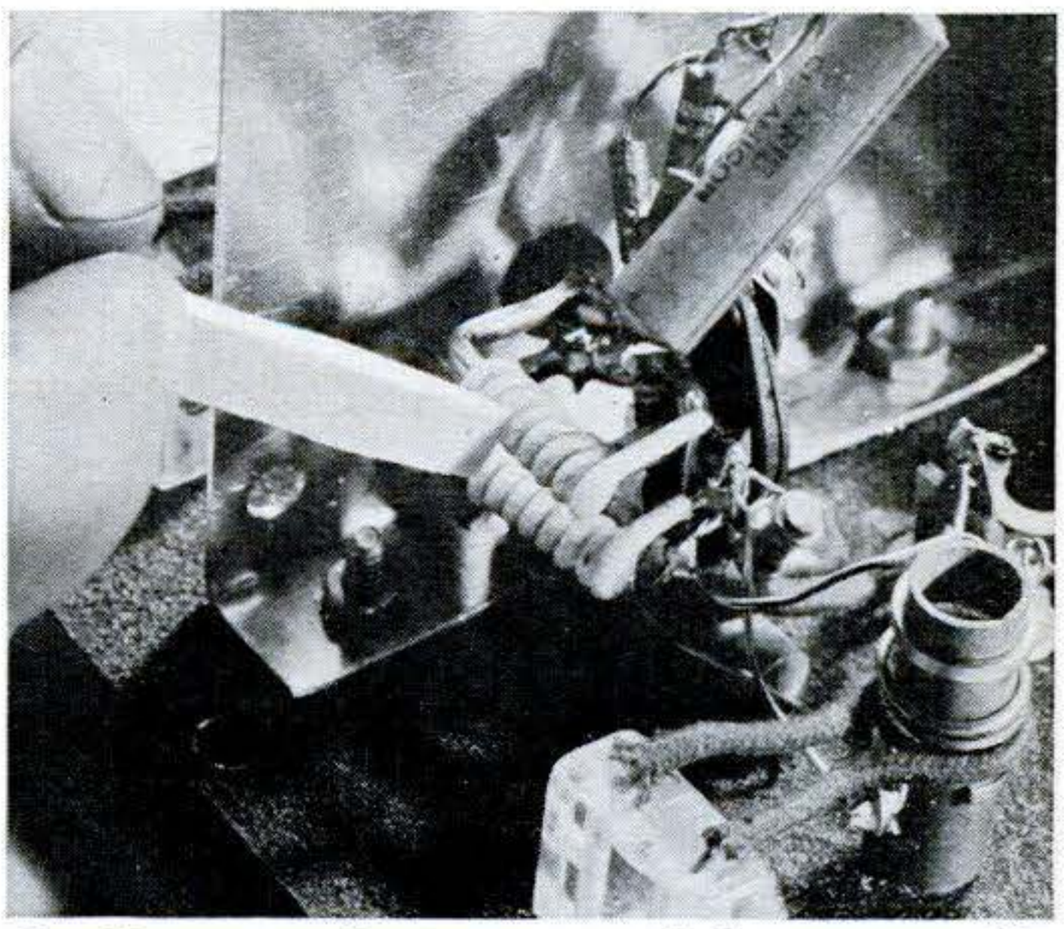


Finished booster. Yours should match critical RF stage, foreground, but may vary elsewhere.

Don't use a pencil or ordinary screwdriver. Move the outer windings in or out on the bent piece of No. 12 wire (see drawing) until the oscillation stops. The best position will probably be where the outer coil is more than half off the inner wire. The coiled wire on both condensers should be in about the same position. Once the circuit is properly neutralized it should need no further adjustment. But adjusting it may take quite a while. Move the tuning slugs in or out till the signal comes in strongest. The two slugs should be out about the same distance when properly adjusted for any station.

Modifying your coils slightly may increase the boosting action. Experiment by squeezing the windings a little closer together or spreading them a little farther apart. END



Oscillation in the booster will show up as odd, wavy patterns on the TV screen. To cancel it out, adjust the neutralizing condensers by sliding the coils along the inner wires.

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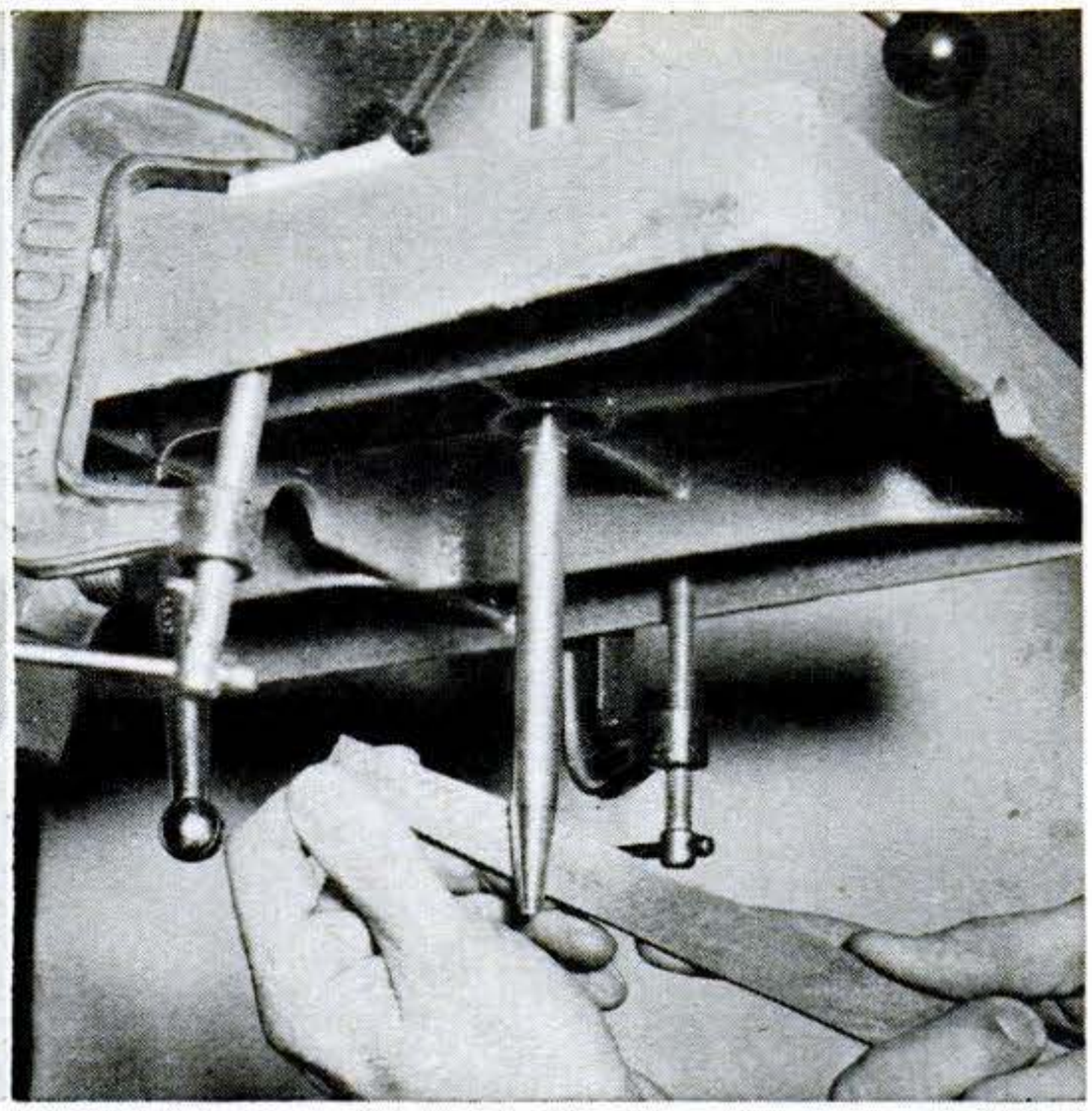
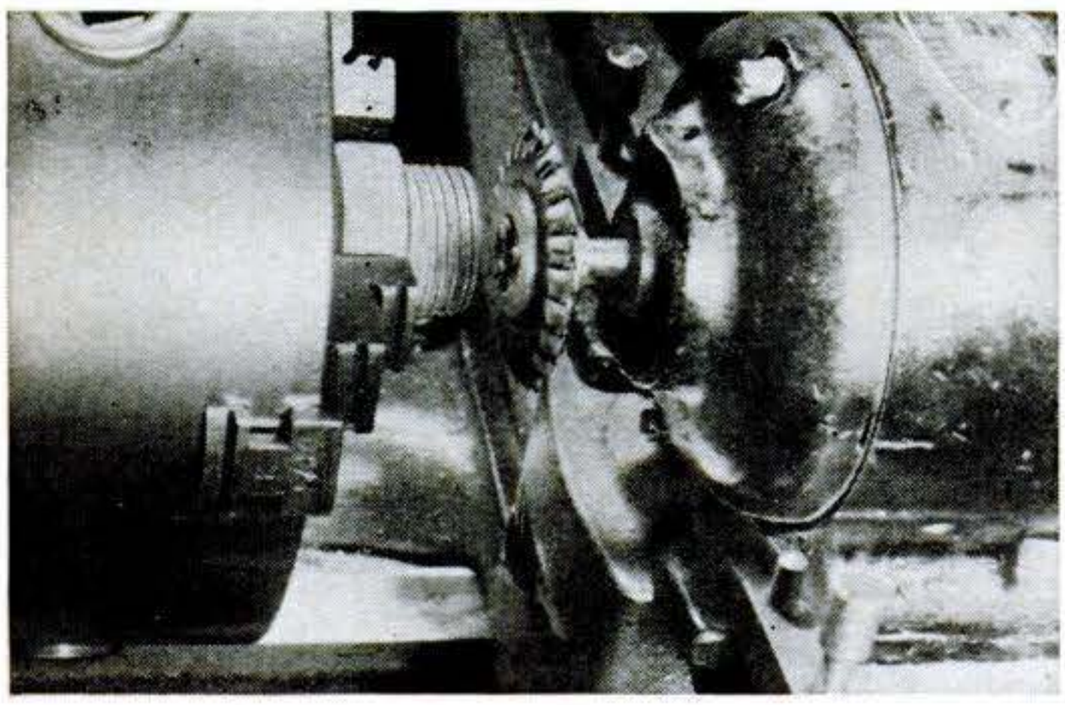
New Shop Ideas

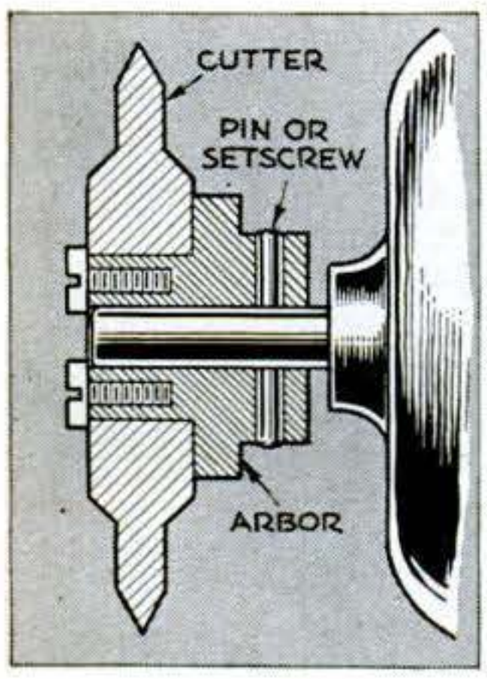


Emergency Lathe Setup. Lacking a lathe, you can use a drill press to file points, shoulders, and grooves on long rods. The setup shown won't pull the chuck loose from a tapered spindle unless you let it chatter.

Bore a hole in a piece of hardwood to fit the rod closely. Pass the rod through the wood and the table, and chuck it. Lock the table at a convenient height, and clamp the wood on it. Stock can be cut off with a steadied hacksaw blade.—*Walter Haase, Hartford, Conn.*

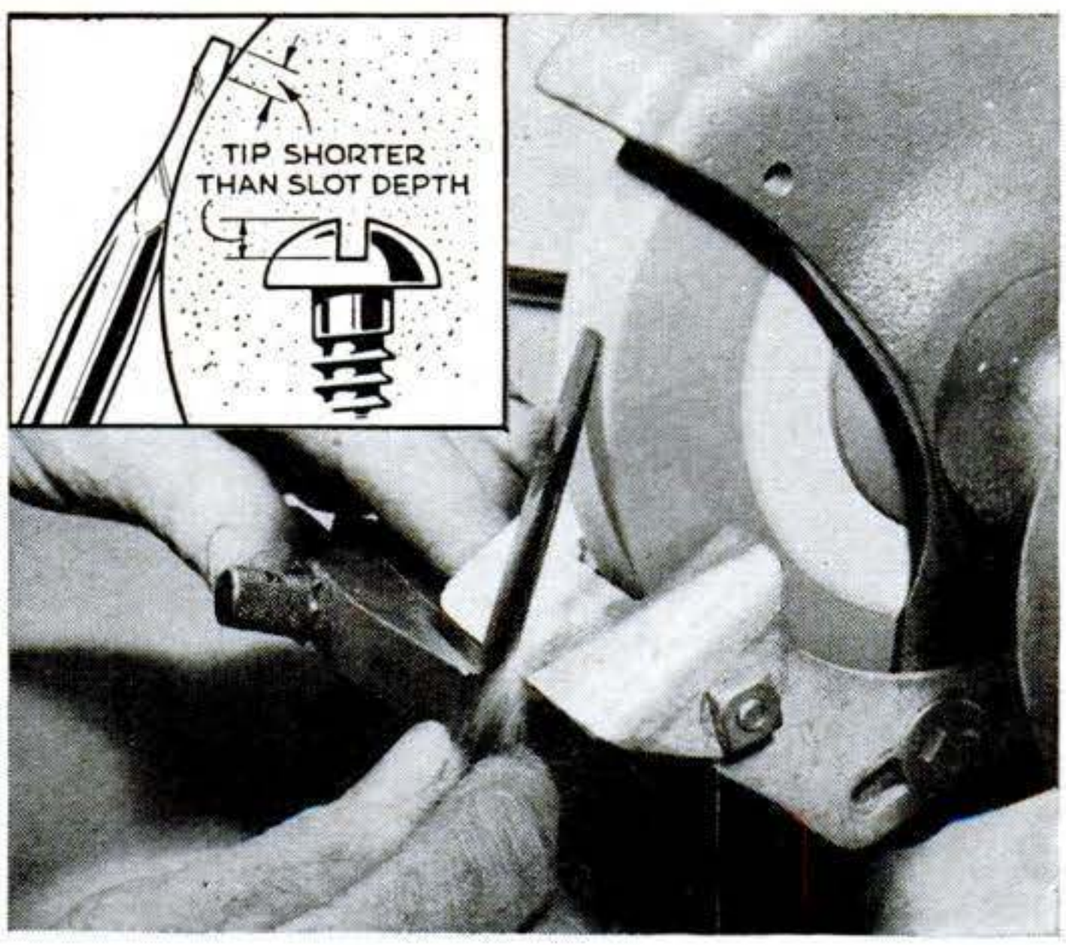


Milling Threads in Wood. Having to make a number of wooden plugs with threaded bodies, I found ordinary threading bits tore the wood and gave poor results. Instead, I mounted a 60° milling cutter on the shaft of a small universal motor as in the drawing, and clamped the motor on the compound rest. The revolving cutter was fed by the lead screw to give the desired pitch, so any thread could be cut. Three pinch screws held the cutter for shoulder clearance. If this isn't needed, a nut would do.—*F. McGuckin, Ridgewood, N. J.*



Hollow-Ground Screwdriver. Burrs or deformed slots are a sign of poorly ground screwdrivers. Here's a good way to grind them, especially for driving nickel-silver, brass, and other "finish" screws.

Grind the tip square, far enough back to take out nicks. Then tighten a parallel clamp on the shank at right angles, as shown below. Its position, and that of the tool rest, should bring the beveled end tangent to the grinding wheel, with the tip not quite touching. Grind a radius just short of the tip. Then flip over, with the other jaw of the clamp under the tool rest, and grind equally. Do not overheat the steel.



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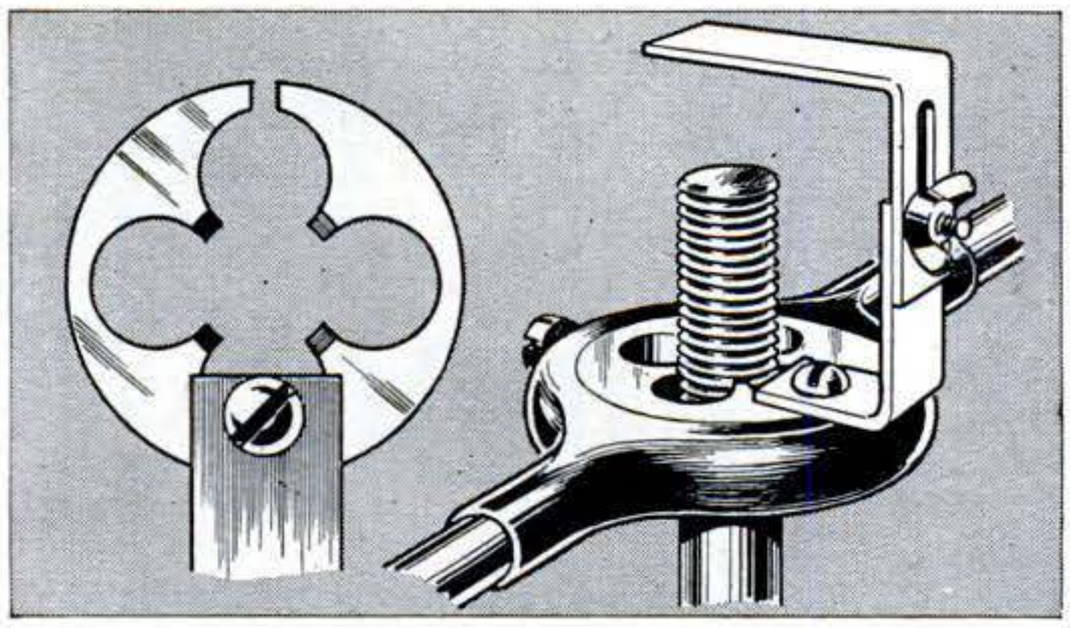
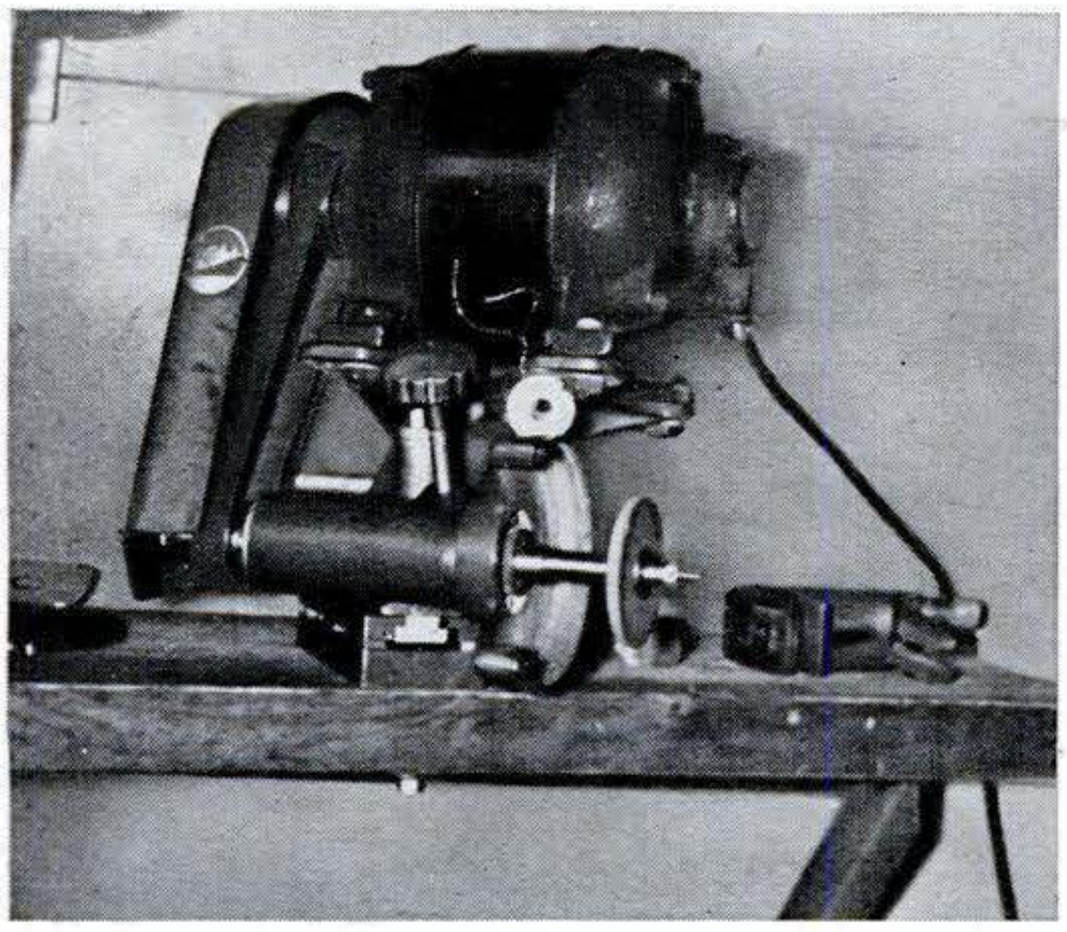
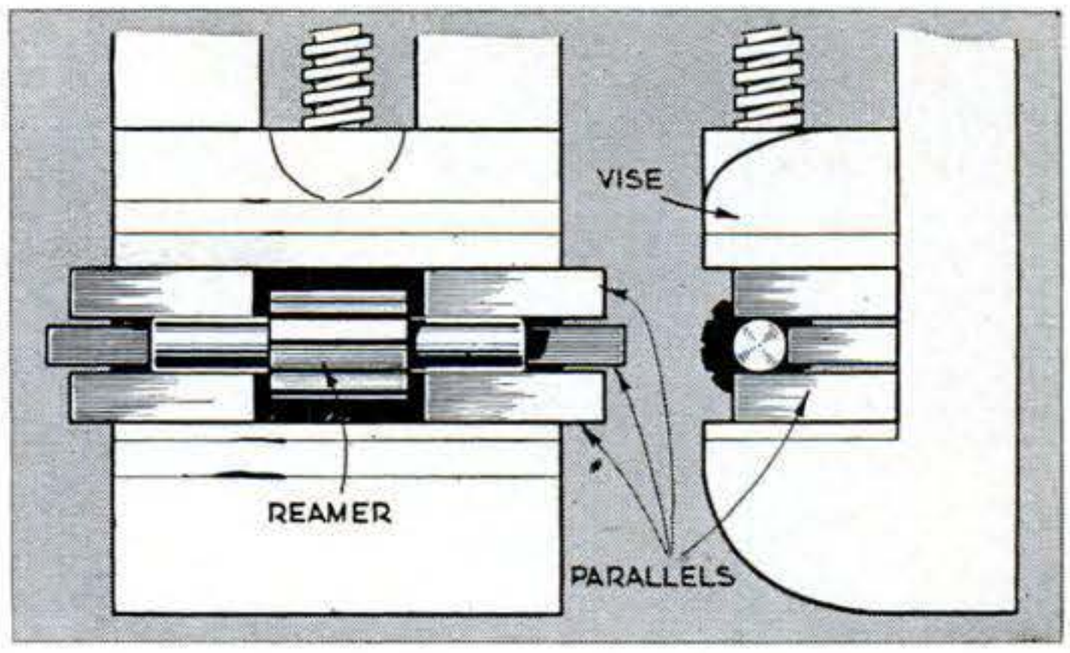


Die Stop Speeds Threading. When a number of pieces have to be threaded the same length, a stop does away with both measuring and over-threading. For an adjustable stop, use two L-shaped pieces, one of them slotted, and join them with a bolt and a wing nut. A fixed stop may be a strip bent in two places to desired length. Attach either stop with a bolt passing through one of the chip-clearance holes in the die.—*W. Shields, Bloomington, Ill.*

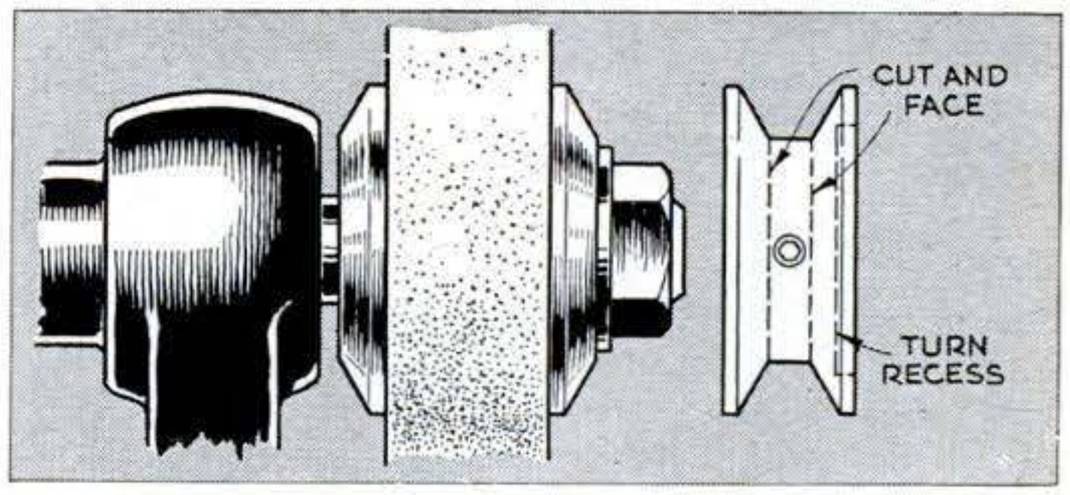
Improvising Wheel Flanges. Need mounting flanges or washers for a small grinding wheel? Saw apart a small V pulley as shown at right and face the cut surfaces in the lathe. If the pulley has flat outer faces, recess each one to get the relieved form that's recommended. A 2″ pulley is right for a 6″ wheel; for an 8″ wheel, use 3″ flanges.

Extra Use from Grinder. If you mount your tool-post grinder on a wall shelf as shown below, it will prove handy for grinding small drills, tool bits, screwdrivers, and so forth. A plate with a T slot similar to that of the tool post should be bolted to the shelf. This makes it easy to mount or detach the grinder quickly.—*John W. Everson, West Orange, N. J.*

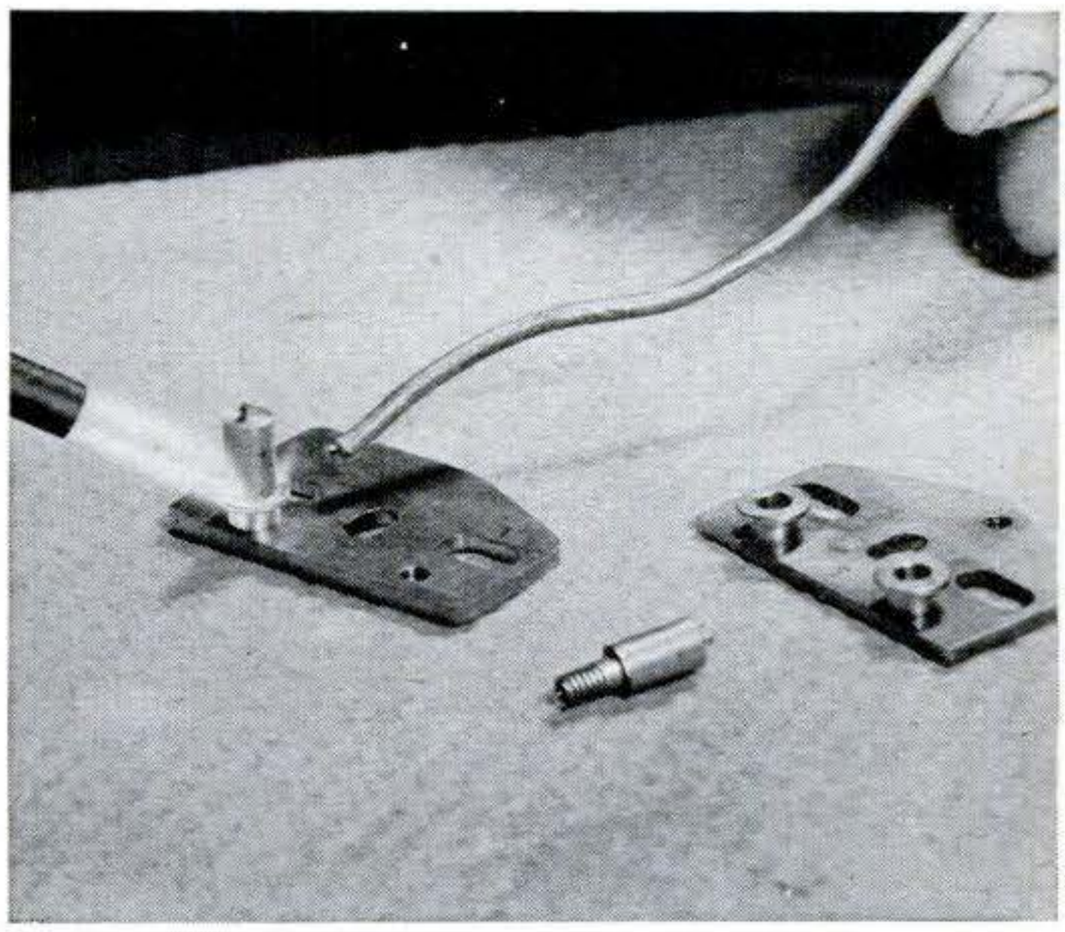




Holding Double-Ended Work. It's worth remembering that work with an enlarged middle diameter can be held in a machine vise as pictured above. In this case a reamer with a short shaft at each end had to be held in a shaper vise. Neither shaft alone afforded a secure grip, and the teeth could not be clamped without damaging them. Parallels of two different heights did the trick. In a pinch, pieces of bar stock will do.—*Federico Strasser, Santiago, Chile.*



Solder-Free Retainers. In fabricating some parts, it was necessary to hold small bosses over tapped holes while they were soldered on. Aluminum studs, threaded to fit the holes and turned a push fit in the bosses, located them precisely and came out freely afterward, since ordinary solder doesn't hold on aluminum. In unthreaded holes, such studs could be held with nuts.



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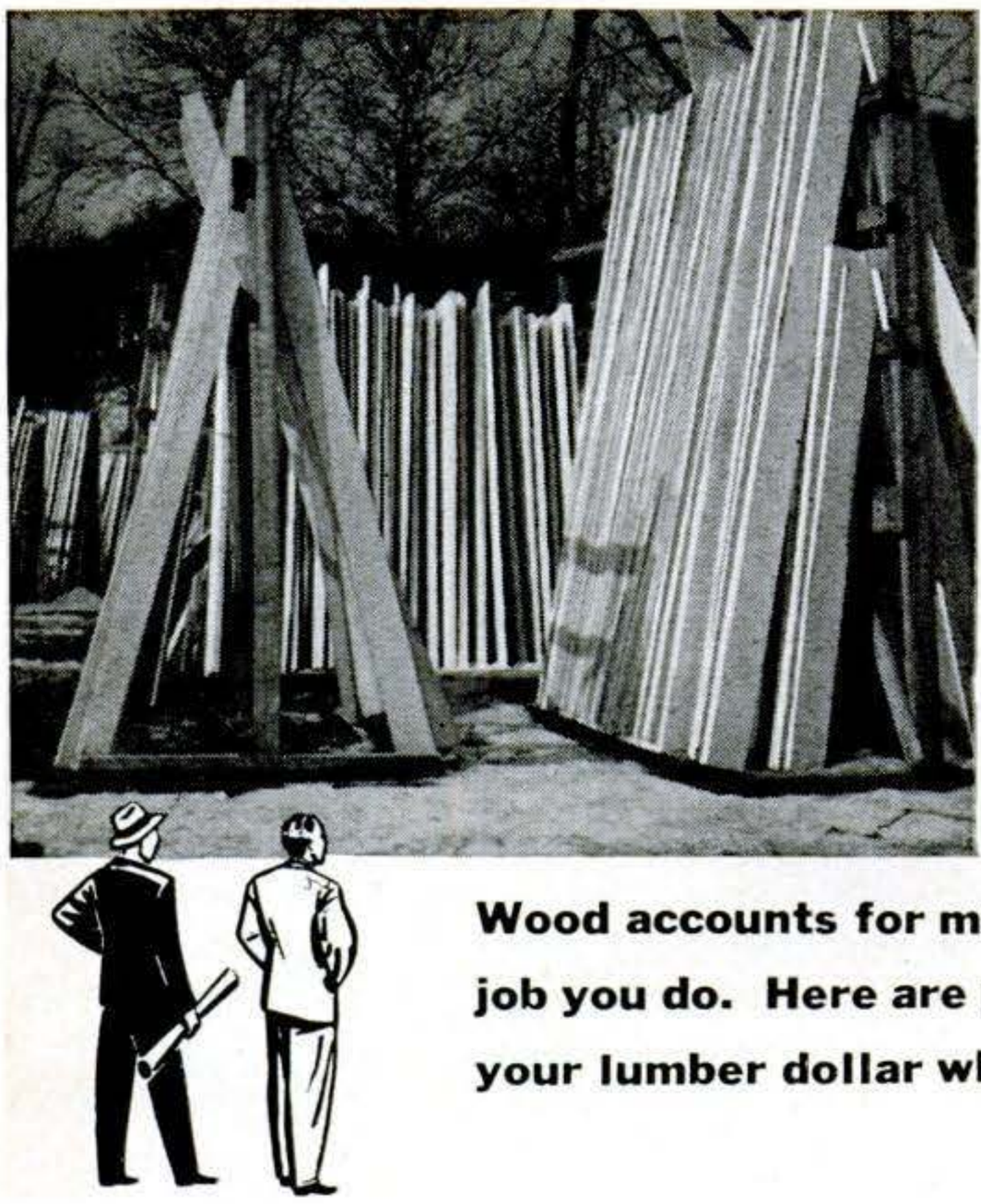


How to Buy Lumber

By Harry Walton

Wood accounts for most of your cash investment on any job you do. Here are pointers to help you get the most for your lumber dollar when shopping at the yard.

B AND BETTER

This includes Grade A, which some manufacturers do not segregate. B and better permits only very small defects such as pin knots.

C SELECT

This grade allows about twice as many small imperfections as B, with a greater proportion of small knots. All can be hidden by paint.

D SELECT

May have any number of surface defects that can be hidden with paint, more and larger knots than C, and a poorer back.

NO. 1 COMMON

Sound, with tight knots of a limited size and some pitch pockets. Considered a watertight lumber. A few unsound or broken knots.

NO. 2 COMMON

Permits large, coarse defects such as grain-tight knots, about 10 percent loose or unsound, and a small amount of other defects and decay.

NO. 3 COMMON

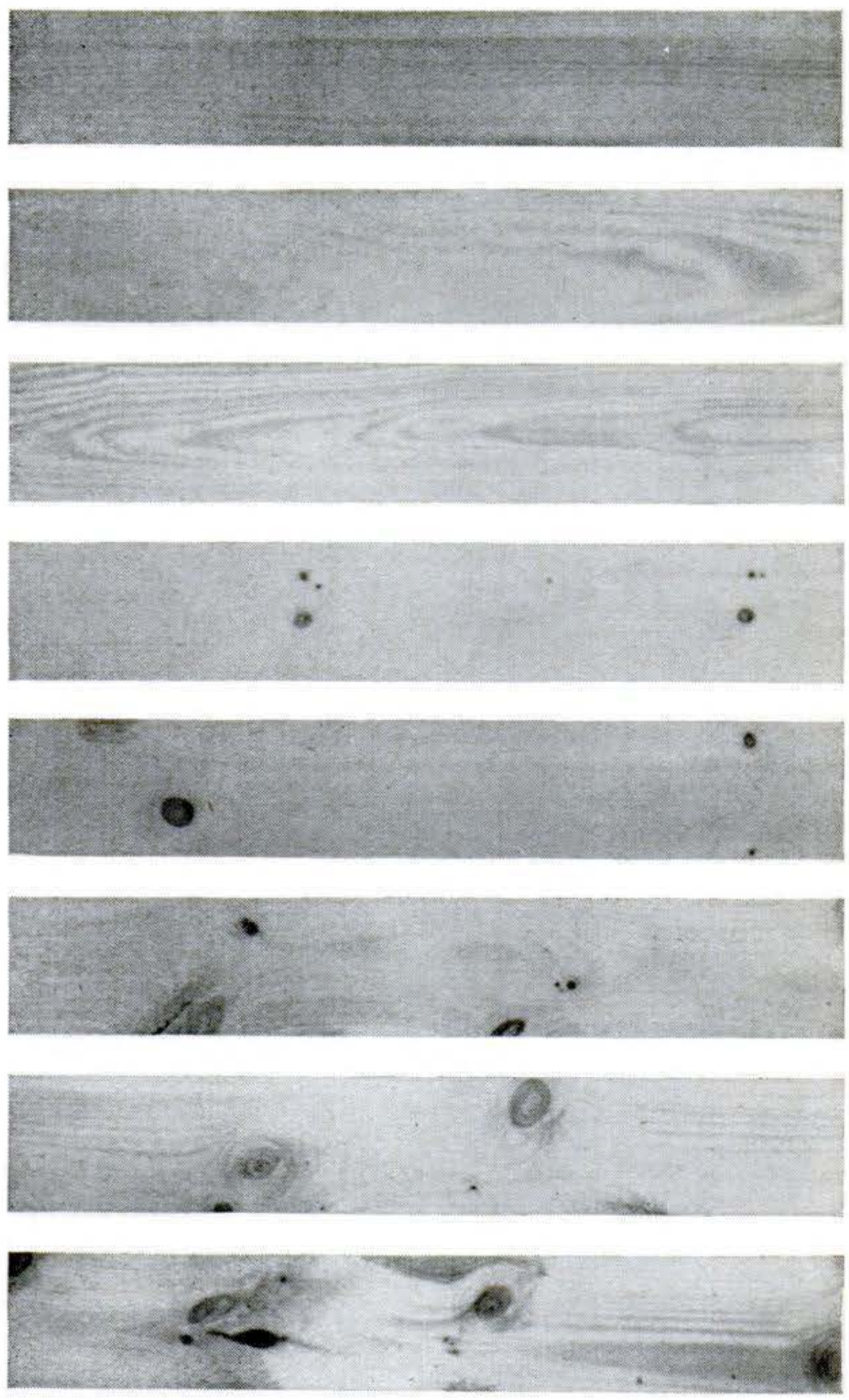
This grade allows larger, coarser knots and even knotholes, as well as more shake (splits parallel to grain), pitch pockets, and decay.

NO. 4 COMMON

A low quality permitting holes and decay; not graded for use as whole boards. Waste in cutting out defective material is to be expected.

NO. 5 COMMON

A very poor grade, not worth shipping far from mill areas and therefore not widely available. Suitable only for very rough or temporary work.



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PERHAPS the high cost of clear pine boards has been the reason you never put up shelves in your garage, or a storage wall in your cellar. If that's so, a second look at your lumber dealer's stacks may be in order. Any project worth your time is usually worth the cost of its materials, if you pick them right.

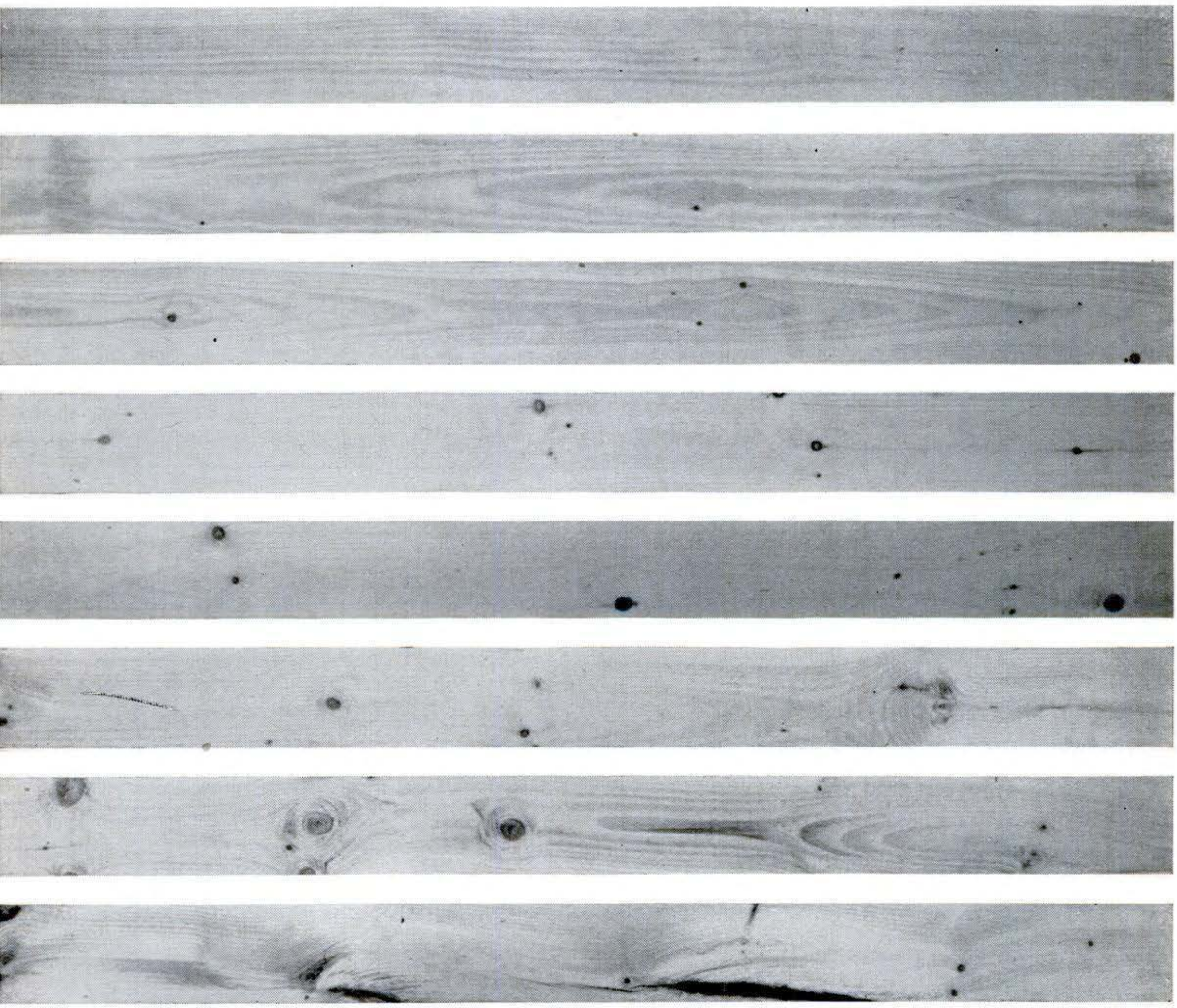
You can't make a breakfront cabinet from crating stock, but you don't need high-priced finish lumber for workshop shelves. Like milk and eggs, lumber is graded according to quality. The wise buyer takes the lowest grade suitable for his purpose.

How wood is graded. If lumber specifications have sounded like double talk to you, they needn't from now on. The photos on this page show typical grades of building lumber, as listed by the U. S. Department of Agriculture. Grading practices vary somewhat, however, among lumber associations.

In building lumber, the finish grades are usually B Select and better, C Select, and D Select. No. 1 to No. 5 Common are utility grades. In hardwood, corresponding grades may be labeled First and Seconds, Selects, No. 1 and No. 2 Common, Sound Wormy, No. 3A and No. 3B Common. Some manufacturers stamp the grade right on their lumber.

As the name implies, appearance is a prime consideration in finish lumber, although dryness and freedom from defects are also important. The natural beauty of grain, and the way it takes paint or other finishes, make it the choice for jobs that are to look well. In the utility-board grades, stiffness and dryness are more important than appearance.

The project decides. As prices for the upper common grades of softwood may be much less than for the lower select grades,



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it pays to buy only as good a quality as the job really demands. In strength, structural stability, and durability, the cheaper grades may be quite the equal of the dearer ones.

The kind of wood to use will also depend in part on the best buys in your locality. Lumber stocks vary greatly in different parts of the country: redwood is plentiful in California, but pine is more common on the east coast. For home remodeling and repairs, softwoods such as pine, hemlock, cedar, fir, spruce, cypress, and redwood are commonly used. Flooring may be a softwood like Arkansas pine, or a hardwood like oak or maple. Trim, built-ins, and furniture may be made of softwoods, or such hardwoods as ash, birch, walnut, gum, and cherry.

In part, the choice depends upon the final finish. If you want the grain to show, you will select wood differently than if it is to be painted or enameled. With an opaque finish, the raw appearance of the wood is not important so long as there are no splits, loose knots, or pitch pockets.

Decay resistance, important in fences, posts, gates, porch members, etc., varies greatly among woods. Cypress, locust, cedar, redwood, chestnut, white oak, and dense Douglas fir are durable even when exposed to soil moisture and other conditions that promote decay.

The dwindling two-by-four. It's not by conspiracy that a two-by-four never measures that. At the start, lumber is rough-sawn in this and other standard sizes. Then seasoning dries it out and in the drying it shrinks somewhat. The planing mill removes still more stock in smoothing the rough surface left by the saw. So the two-by-four dwindles in cross section to 1⅝″ by 3⅝″, but is still given the nominal size of its rough-sawn dimensions.

Planing reduces 1″ lumber to 25/32″. In 2″ to 6″ thicknesses or widths, the loss is about ⅜″. Above 6″ it's a full ½″ in thickness, but ⅜″ in width. Thus a two-by-six will measure 1⅝″ by 5⅝″, and a one-by-eight, 25/32″ by 7½″.

Dressed stock is designated as S2S (surfaced two sides), S1E (surfaced one edge), and so forth. A piece dressed on two sides will, of course, remain its nominal size across the unsurfaced sides, so that a four-by-four S2S will measure about 3⅝″ by 4″.

How the bill is figured. The unit of lumber measure, called the board foot, is based on its rough-sawn (nominal) size, and means a piece 1″ thick by 12″ square, or its equivalent. A plank 2″ by 12″ by 8′ long would therefore be charged as 16 board feet. To find the number of board feet in a piece, multiply thickness in inches by width and length in feet. Any thickness less than 1″ is charged as 1″. Price is usually expressed as so much per thousand board feet.

Most lumber is sold this way, but molding goes by the running foot, lath and shingles by the bundle or square, plywood by the square foot, and posts or poles by the piece.

House lumber comes in lengths from 8′ to

LUMBER GRADES

B Select and better, also called No. 1 and No. 2 clear. Highest quality and almost free of blemishes. Most expensive. Exterior or interior trim, fine flooring, cabinetwork and other built-ins to be finished natural.

C Select. Next in quality and price. About twice as many knots and minor imperfections as in B, but all easily covered with paint. Exterior details, porch columns and flooring, interior trim and fixtures to be painted.

D Select. Lowest of the better grades. Same defects found in C but more of them. Larger knots, a few of them loose, but all defects concealable by painting. Interior work to be painted. Shelving and millwork.

No. 1 Common (or Boards No. 1) First of board grades, a good general-purpose wood. Small, tight knots. Free of large, coarse defects, but not all concealable by painting. Exterior trim, siding, door and window frames, cheaper interior work.

No. 2 Common (or Boards No. 2) All-around utility grade. Knots are scattered, but may be large and a small percentage unsound. Cupboard shelving, subflooring and rough flooring, knotty pine paneling, siding on cottages and garage.

No. 3 Common. Knots are plentiful and not necessarily sound or tight. Has knotholes and other defects such as heartshake, (splits crossing the rings), stain, pitch pockets, and worm holes. Shelves and rougher work. Concrete forms, sheathing, crates.

No. 4 Common. Boards with above defects in a greater degree. Lowest board grade for home use. Useful only for temporary structures, boxes and crates.

No. 5 Common. Poorest quality and lowest price. Usually not shipped outside of mill areas. Temporary protection of structures.

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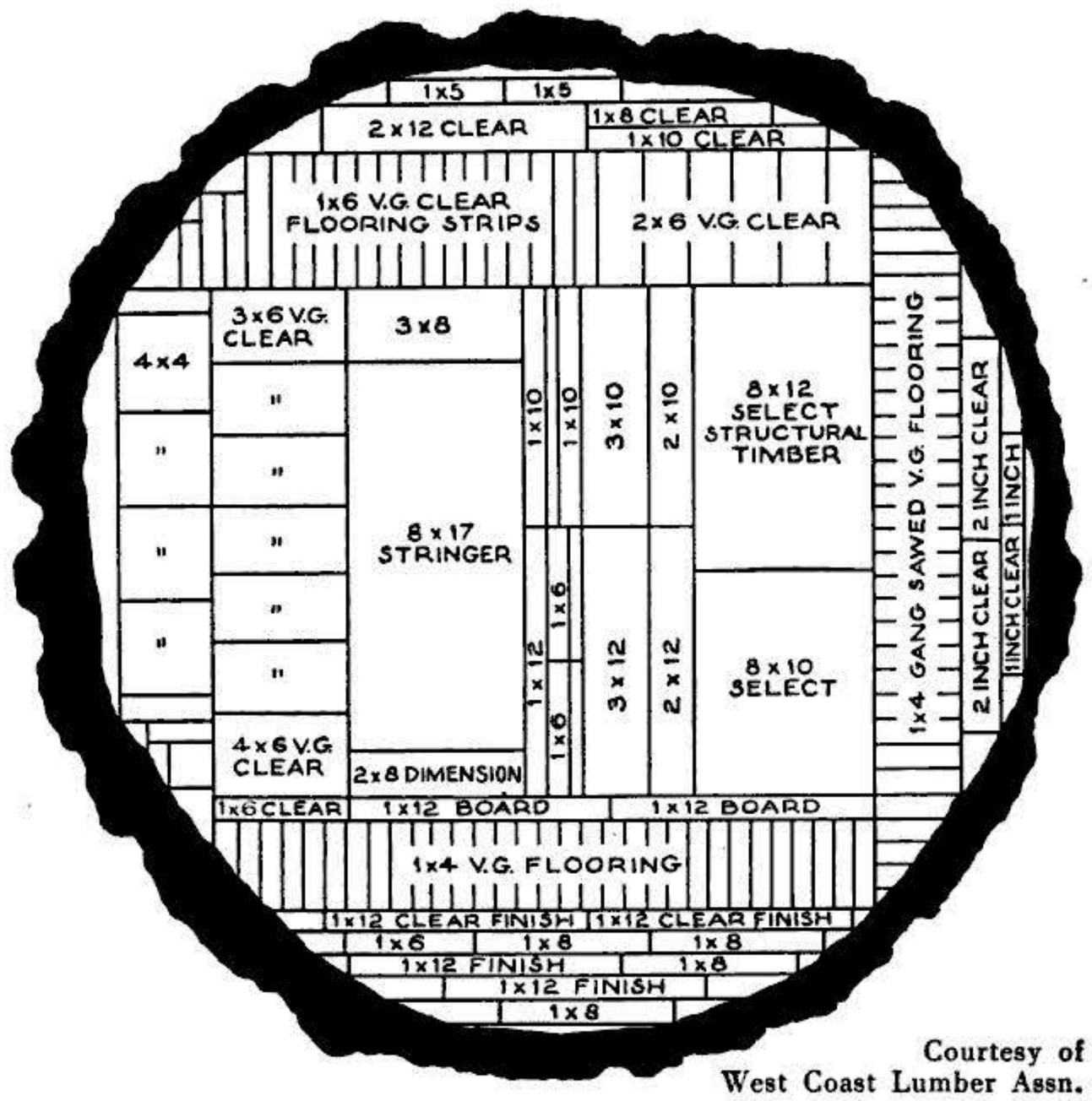
20′, in multiples of 2′ only, except for a few special lengths. Two-by-fours and six-by-eights come in 9′ and 11′ lengths. Certain sizes, chiefly timbers, are available in 13′, 15′, and 17′ lengths. In estimating the footage needed, it's usually advisable to add 15 percent because of waste in cutting standard lengths. For instance, if you want a 7′ board, you have to buy and cut an 8′ length.

Will it warp? As cut, wood is naturally moist. Upon its proper drying, or seasoning, largely depend its strength, stiffness, and freedom from warping. If insufficiently seasoned, the lumber may continue drying after it is in use, changing both shape and size in the process. Seasoning takes months when lumber is air-dried. Kiln drying, in which temperature and humidity are closely controlled, takes only a few days. Buying grade-marked lumber is one way to be reasonably sure you are getting properly seasoned wood.

A simple way to check the dryness of lumber is to saw a 1″-long sample from several flat-grain boards. Make them the full width and then trim them to exactly 6″. Place the samples in a slow oven for three or four hours, or over a radiator for about 48 hours, and then measure each with a rule.

Wood that is to be used for framing can shrink as much as ½″. High-grade trim wood should not shrink more than from 1/16″ to 3/32″. When the wood you want to check is less than 6″ wide, make the samples 3″ instead of 6″. Allowable shrinkage will then be half of that for the larger sample. Edge-grain lumber shrinks only about half as much as flat grain. END



Courtesy of West Coast Lumber Assn.

How log is cut to yield vertical or edge-grain wood.

Readers who save *Popular Science* Information Cards (like the one below) are enthusiastic about them. Start saving yours now.

HOUSE LUMBER

The U.S. Forest Service reports these woods most suitable for building a house:

Framing—Douglas fir, western larch, southern yellow pine; *flooring*—hard maple, red and white oak; *subflooring*—Douglas fir, western larch, southern yellow pine; *sheathing*—cedar, cypress, hemlocks, northern white pine, ponderosa pine, sugar pine, western white pine, redwood, spruce, white fir, basswood, chestnut, yellow poplar; *siding*—cedar, cypress, northern white pine, sugar pine, western white pine, redwood; *exterior trim*—cedars, cypress, redwood, all heartwood only; *interior trim* (natural)—ash, birch, cherry, chestnut, oak, sycamore, walnut; *interior trim* (painted)—birch, cherry, walnut, yellow poplar; *lath*—jack pine, lodgepole pine, northern white pine, sugar pine, ponderosa pine, western white pine, spruce, white fir, yellow poplar; *roof boards*—Douglas fir, western larch, southern yellow pine; *sash*—northern white pine, ponderosa pine, sugar pine, western white pine; *outdoor steps*—cypress, white pine, both heartwood only; *shingles*—cedar, cypress, redwood, all heartwood only.

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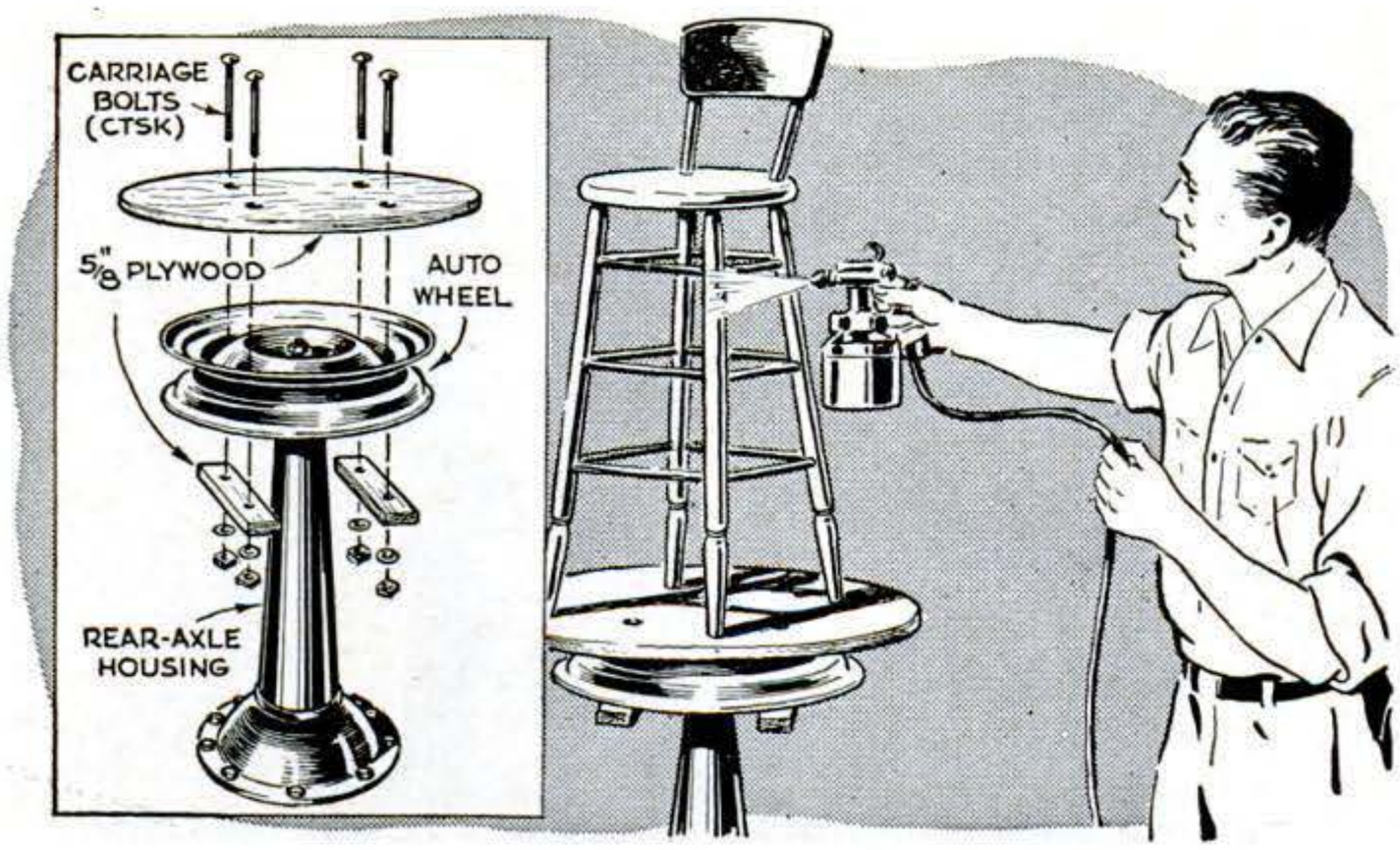
Rotating Spray Table from Auto Parts

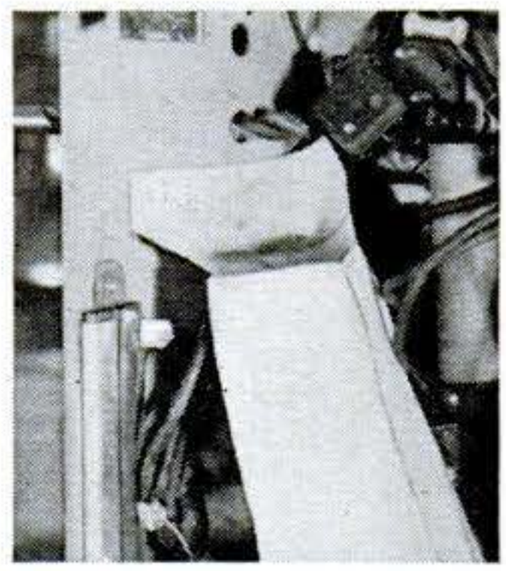
A SIMPLE yet sturdy rotating table for paint spraying can be made from old automobile parts and a piece of plywood. Any junk yard will be a source for the half axle housing, shaft, bearing, and wheel. The unit is secured to the shop floor with lag screws through the bolt holes in the housing bell.—*Victor H. Lamoy, Upper Jay, N.Y.*



New Lightweight Kodak Has Ektar Lens

FOR 35-mm. fans, the Eastman Kodak Company now offers its new Kodak Signet 35 (below). Fitted with an f/3.5 Ektar lens and built-in rangefinder, the 18-ounce camera is small enough to slip into your coat pocket. The shutter has four speeds—1/25, 1/50, 1/100, and 1/300 sec. (plus bulb)—and is synchronized at all speeds for Class M flash lamps. The camera sells for about $95.

Keeping Chips Out of Radio Chassis



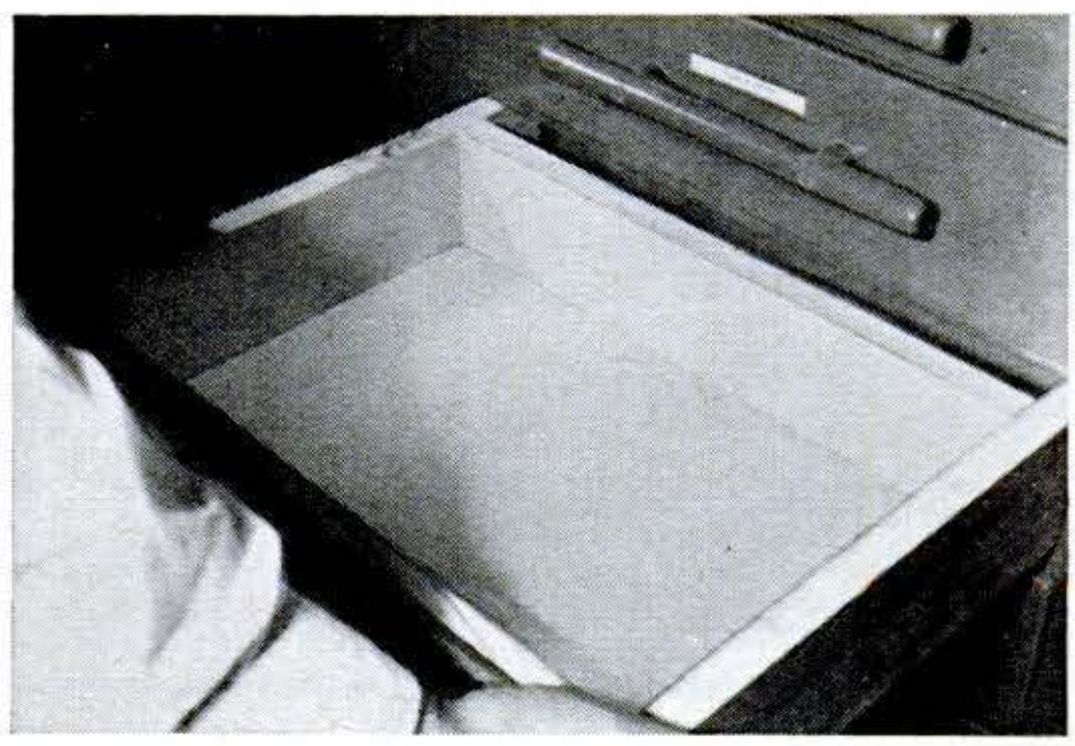
WHEN you drill holes in a wired radio or electrical chassis, don't let metal chips or cuttings fall into the maze of wires, sockets, and connections. A small envelope taped to the chassis just below the hole will catch chips carried through on the drill.—*Walter E. Burton, Akron, Ohio.*

Horseshoe Props Up Tree Limbs

TREE limbs, when heavily laden with fruit, are often in danger of excessive bending or cracking. A horseshoe nailed or bolted to a piece of lumber or a sapling pole of sufficient length makes an excellent prop.—*Douglas Cresswell, Baltimore.*

Shop Drawers Can Be Kept from Tipping by Sacrificing Space

YOU can get smoother, non-tip, non-spill service out of the tool drawers in your workshop by sacrificing a couple of inches of unused depth. If you build your own drawers, make the sides 3 or 4 inches longer than the bottom, as shown at right. The extra side length will bear on the supporting rails and keep the drawer level even when it is pulled out all the way. Screw a small wooden turnbutton to the back to stop the drawer in its open position.—*Will Thomas, Buffalo.*



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Tongue & Groove Cut the Cost of this Cupboard

It can be hung in a kitchen, bathroom, or any other room where you need space to store your household supplies.

By Darrell Huff

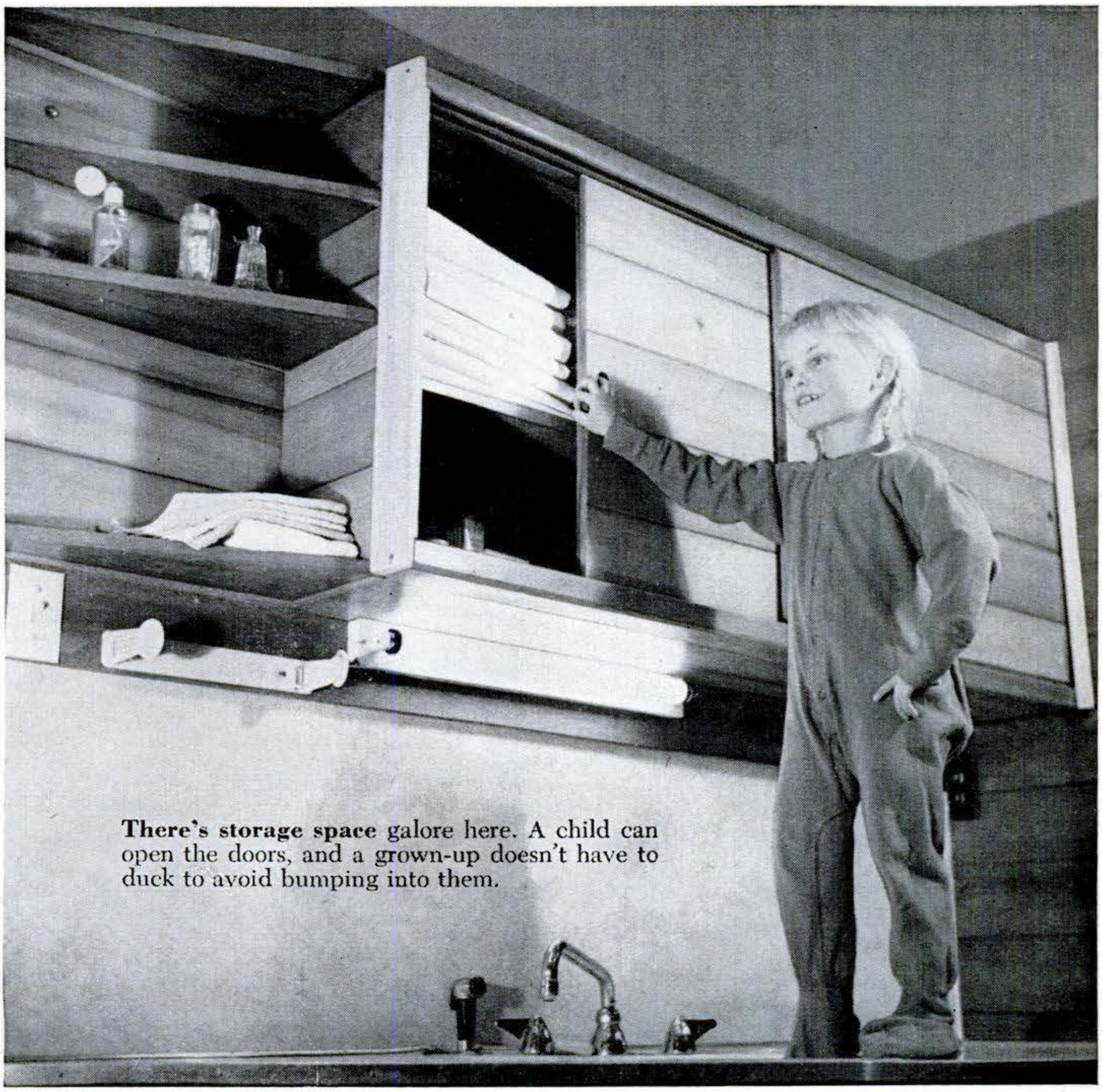
ANYBODY can build anything, the way I see it, if he spends enough money. The trick is to get attractive results at minimum cost.

This over-sink cupboard is an example. It cost very little because:

- I built it myself, and
- I used 1″ by 6″ tongue-and-groove siding of a construction grade, which costs a good deal less than plywood or cabinet lumber but looks good.

Since the cabinet fits against a wall, it did not need a back. Another wall serves as one end, and corner shelves close the other end. And, since the doors slide in the framing, I did not have to buy tracks. Even the door pulls are blind holes instead of store hardware.

Building the framework. Begin by cutting two two-by-fours to the length you



There's storage space galore here. A child can open the doors, and a grown-up doesn't have to duck to avoid bumping into them.

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want the cabinet to be. Groove and rabbet the two-by-fours as shown below. If you don't have power tools, use one-by-fours and build up the grooves with strips of wood.

Six pieces of tongue and groove form the top, bottom, and center shelf. Plane off the tongues and grooves where indicated in the photo below. Fasten the boards to the cleats and to the two-by-fours with finishing nails and glue. At the rear of the top, bottom, and center shelf, notch the corners and centers to take the vertical one-by-threes.

Locating verticals. The location of the verticals didn't matter for the cabinet in my home. The walls are concrete block. So I just drilled through the vertical members, into the concrete, and hung the cabinet with toggle bolts.

If you want to mount your cabinet on plaster walls, place the verticals where they will match the studs. You may have to add one or two more vertical pieces, depending on the cabinet's length.

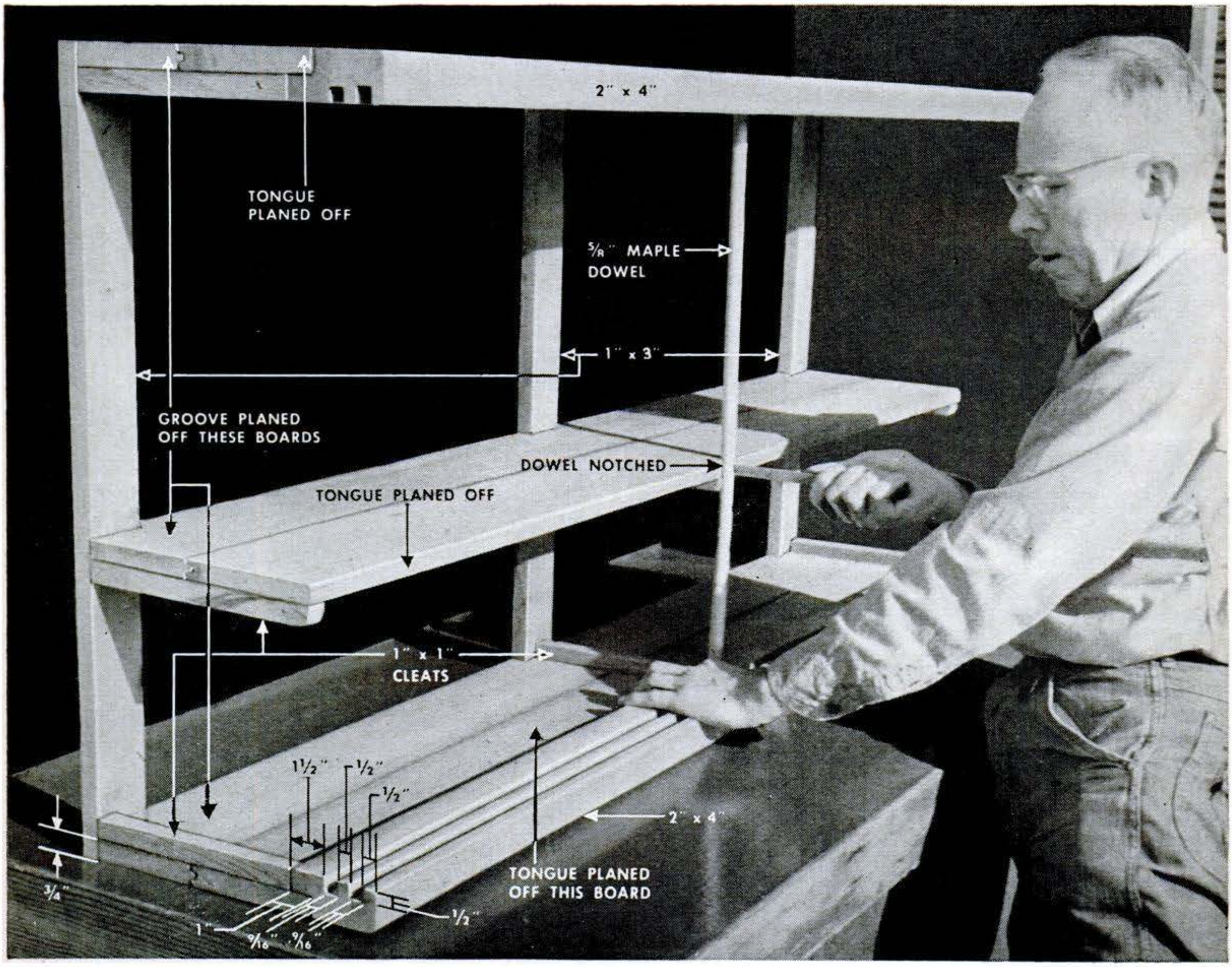
The dowel reinforces the cabinet. It fits in blind holes at top and bottom and is notched to fit the shelf.

Building doors. My cupboard is 28" high, and each sliding door is made up of five pieces of tongue and groove. The doors are each 1" longer than half the length of the cupboard. That way they overlap when closed. Top and bottom edges of the doors are rabbeted to fit the grooves in the two-by-fours.

If the ends of the cupboard don't fit against walls, finish them with more tongue and groove. I wanted extra storage space and built open shelves on one end. Two pieces of trim—one at each corner of the cabinet—finished the job.

I used redwood to match the walls and brushed on two coats of clear lacquer. END

Construction and dimensions are shown below. Dowel, set with glue and one screw, strengthens front. Cupboard can be built entirely with hand tools if you make tracks for the doors by nailing and gluing wood strips to one-by-fours instead of grooving two-by-fours.



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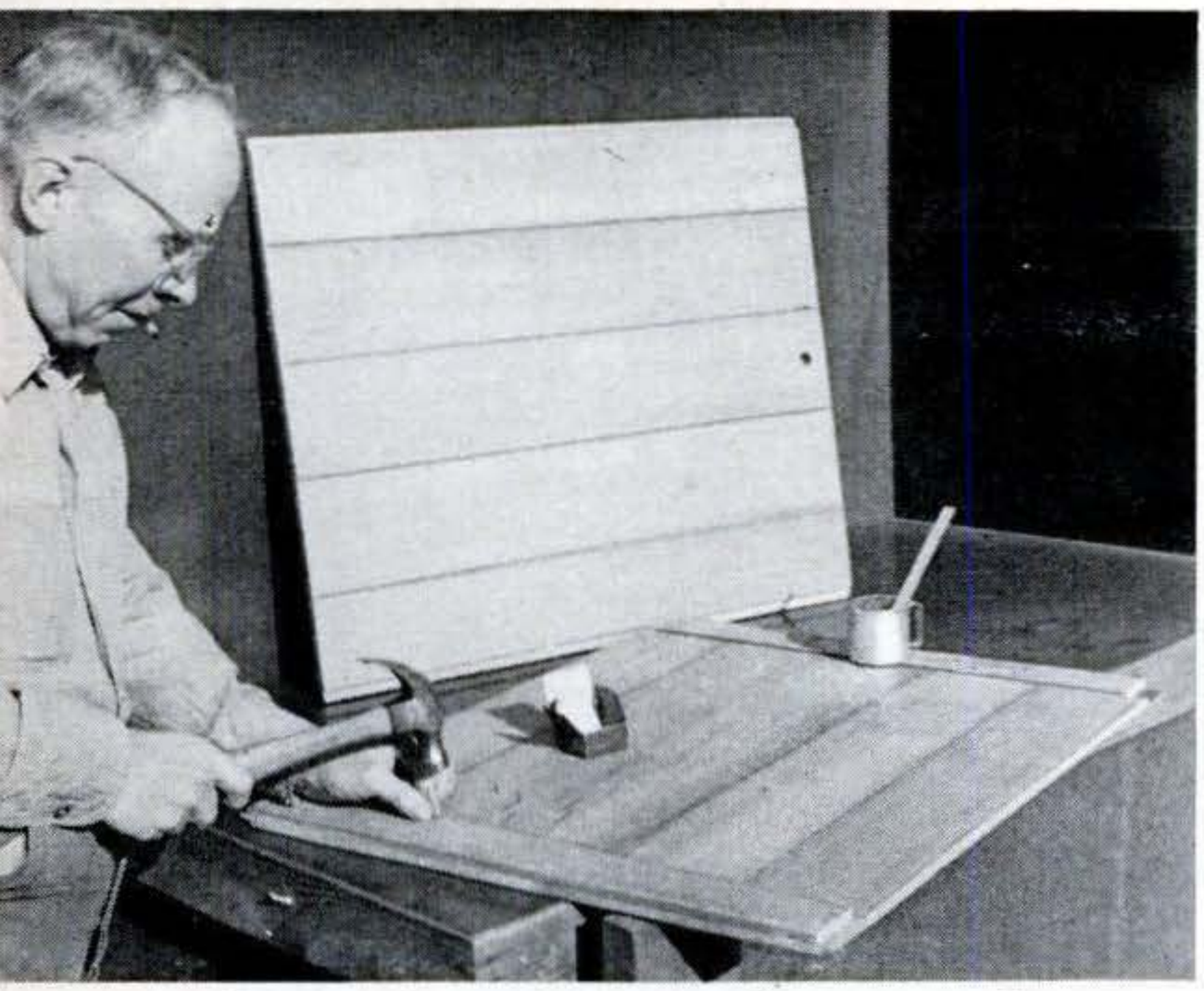
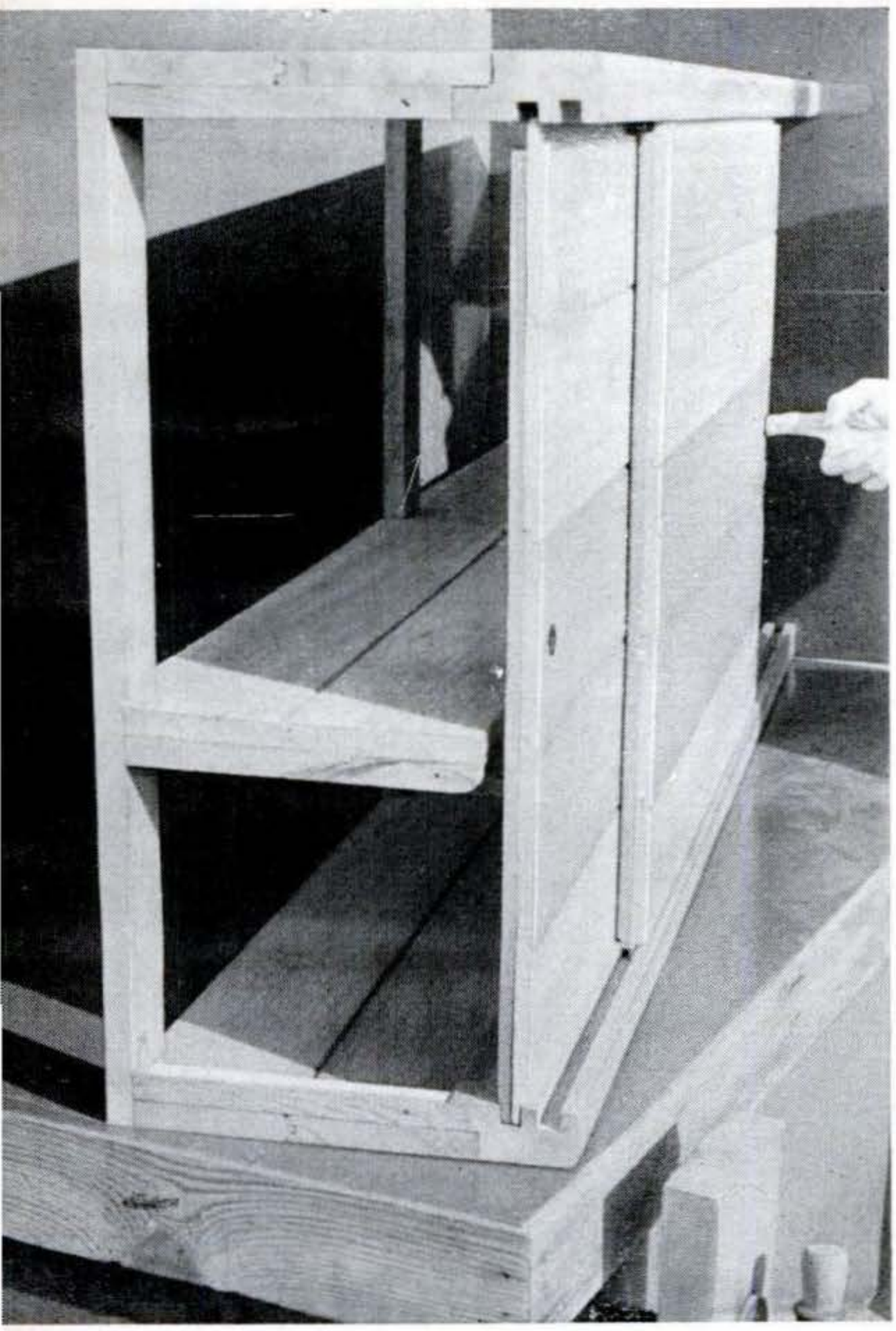


Doors also are made of tongue and groove. Each end of doors is rabbeted to take ½" spline. Nails and glue fasten splines in place.

Tops and bottoms of doors are rabbeted to ride in grooves in two-by-fours. Rub candle wax in grooves and doors will slide more easily.

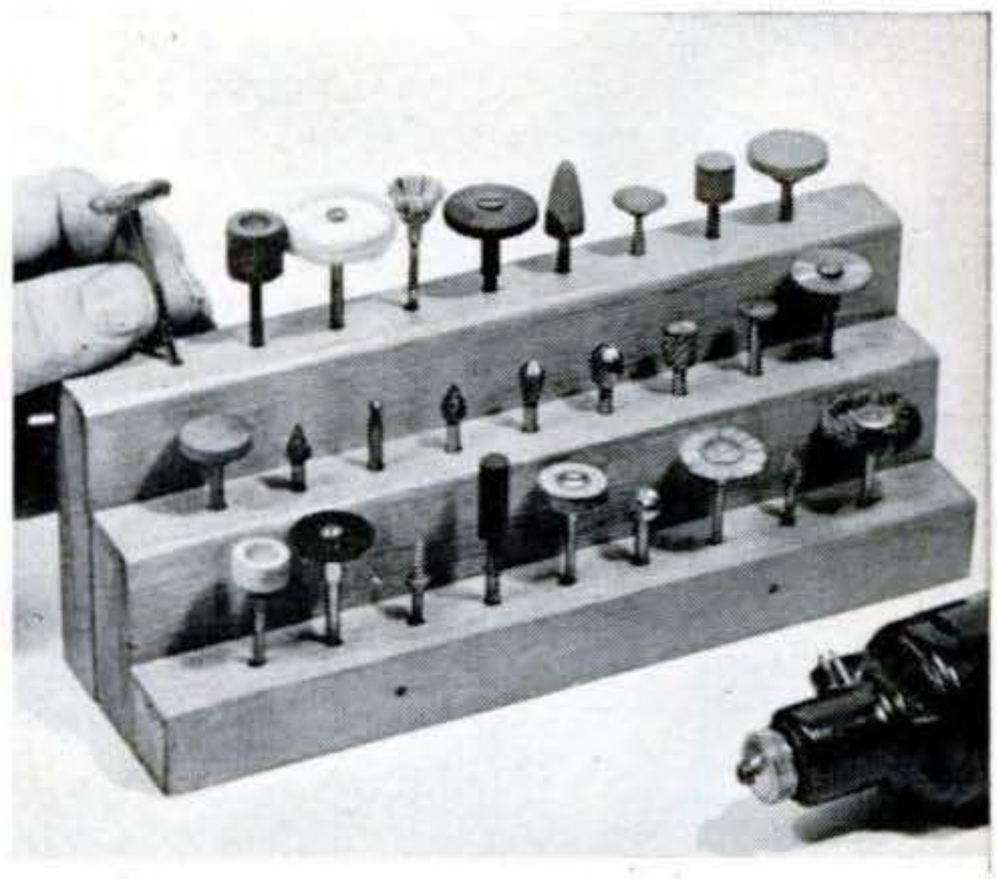


Label Identifies Film in Camera

It sometimes takes weeks to use up a roll of 35-mm. film. In the meantime, you may forget what type you have put in. If the camera has a flash-attachment clip, a label cut from the film box and slipped into the clip like this will show you what kind of film you're using in the camera.—*R. E. Hancock, Portsmouth, Va.*

New Filter Shows Oil Sludge

Openings around the base of a new automotive oil filter enable you to see when you need a refill—instead of depending entirely on mileage. Purolator Products, Inc., of Rahway, N. J., says the "dirt check windows" let you see how much sludge has been filtered from the oil.



Rack Holds Grinder Accessories

Scraps of wood 3", 2", and 1" wide make this easily assembled rack for motor-tool accessories. The brushes, burrs, saws and wheels rest in shallow holes in the 8"-long blocks and are readily removed and replaced. The three blocks are nailed together.—*Robert Hertzberg, Jackson Heights, N. Y.*

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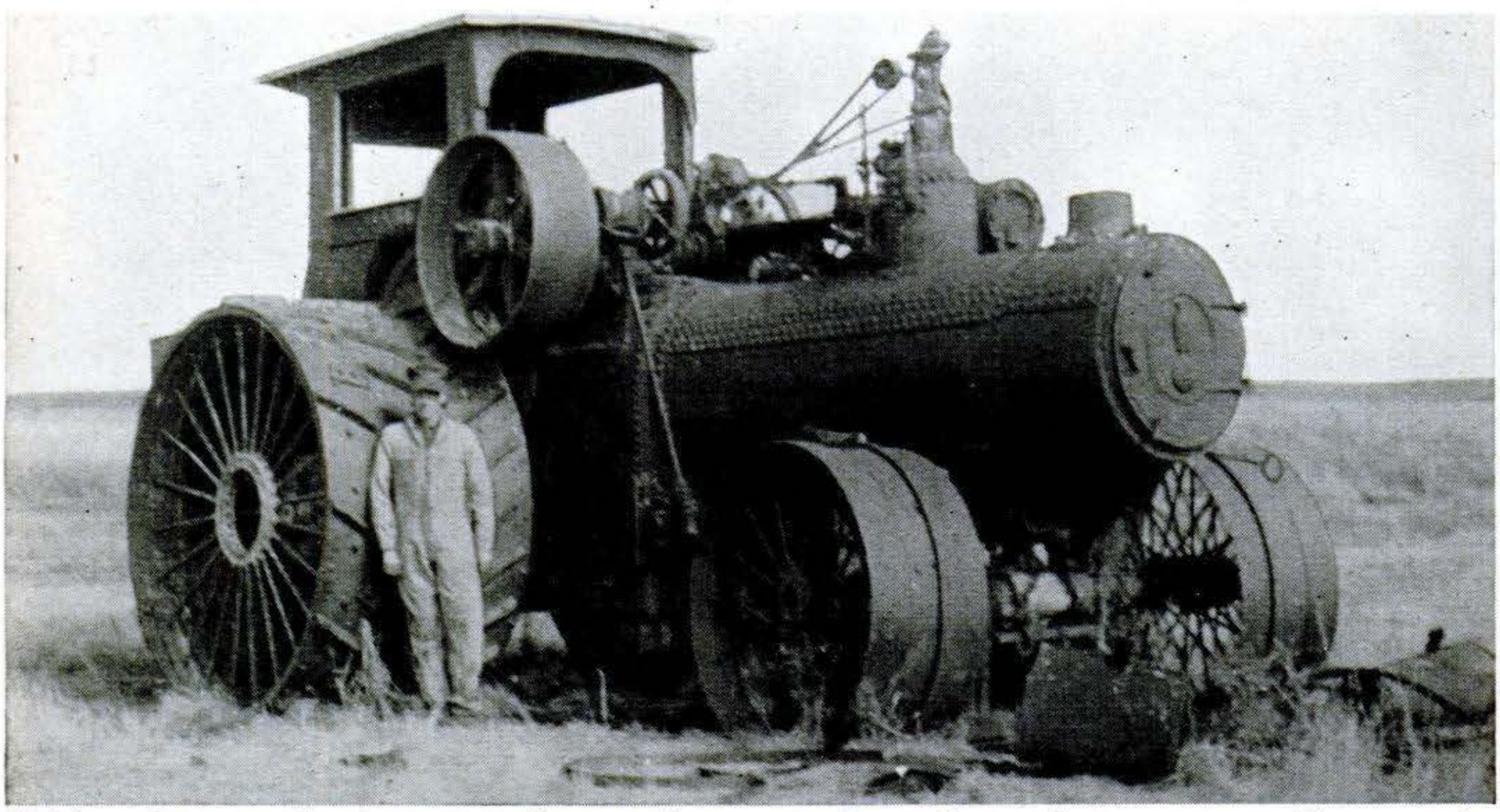


110-hp. Case weighs 21 tons without coal or water in it, is 14 feet high, 22½ feet long, and nearly 13 feet wide. Harrison will restore the 1912 model to its original condition.

There's Money in Steam Engines

Some folk collect stamps, others phonograph records. But not this PS reader. His hobby weighs tons and burns coal.

THERE'S a steam traction engine in Butler, Ohio, with five whistles on it to amuse small boys. It's part of the steam-engine collection of Charlie Harrison, and this unusual hobby has proven profitable for him every threshing season.

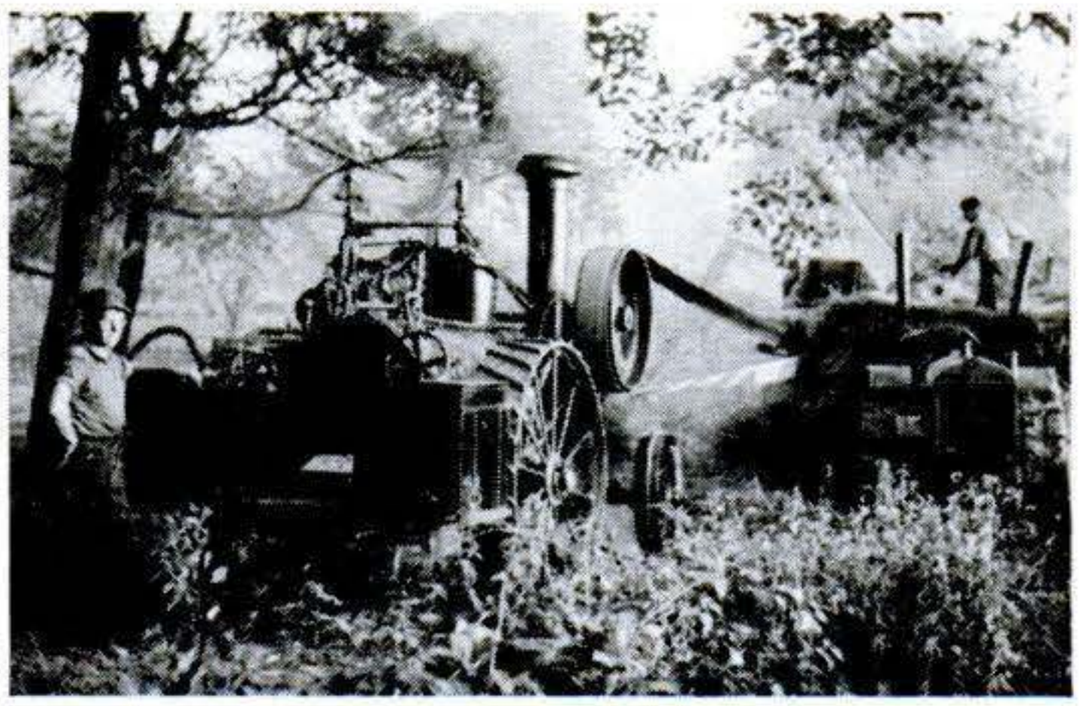
"Farmers like my steam rig better than a tractor rig," he explains, "because it never breaks down or refuses to start—and, anyway, nearly everybody likes to hear and see a steam engine.

"My 20-hp. Aultman-Taylor was built in 1919 and it has cost only about $140 for repairs in 20 years of use. I don't believe any tractor would come close to running that long without being completely rebuilt. My other A-T is so perfectly balanced an 8-penny nail will stand anywhere on it."

Harrison recently traveled 1,350 miles to Lisbon, N. D., to get a 21-ton, 110-hp. Case —and on the way he ran across a 10-hp. Advance, so he bought it, too.

The wife of the man who sold him the Case wanted to know if he was married. "I didn't think so," she remarked, when he answered no. "Very few women would stand for that 21-ton monster sitting in the yard."

20-hp. Aultman-Taylor engine is the most often used item in Charlie Harrison's collection. He now is the owner of nine steam engines.



8-hp. Nicholas & Shepard is oldest and smallest engine Harrison has. It was built in 1898, and he found it on an Iowa farm.

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The Case of the Lucky Camera

This handsome top-grain leather field case for Kodak "Pony 828" protects its camera well—opens in an instant for quick action. $6.50.

A slippery rock! Looks like this camper is heading for a fall. But his camera is lucky. It's snug and protected in a smart Kodak carrying case—therein lies a moral: Protect your camera with a Kodak case for carefree snapshooting next time you go camping.

A smart idea at *any* time, for that matter. Kodak camera cases are designed and constructed to take the hardest knocks and come up smiling. *See your dealer for the one that fits your camera.*

OTHER KODAK CARRYING CASES

Kodak Snapsack for Kodak Tourist Cameras. Rugged pouch-type leather case. $3.95.

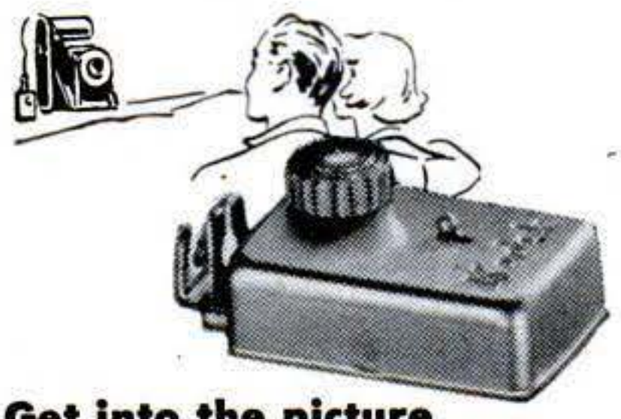
De Luxe Field Case for Kodak Tourist Cameras—$10.50

Field Case for Kodak Flash Bantam f/4.5 Camera—$6.50

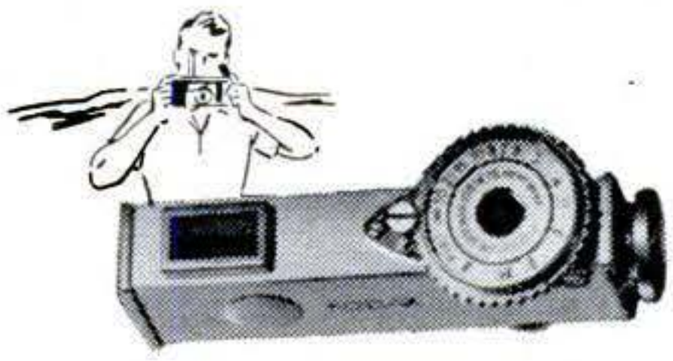
Field Case for Kodak Pony 135 Camera—$6.75

Field Case for Kodak Duaflex Cameras (simulated leather) —$2.50

FOR ADDED FUN AND FINER SNAPSHOTS . . .



Get into the picture yourself—Attach a KODAK AUTO RELEASE to any camera which has a cable release . . . set it . . . you have 10 seconds before the shutter clicks. (Swell for honeymoon couples!) Good for flash shots, too. $4.25.



You can even focus on a fly with the neat little KODAK SERVICE RANGE FINDER. Split-field military-type. Adjusts down to 2 feet. Use independently of camera—or attach by means of special bracket provided on many models. $14.58, including case.

Prices are subject to change without notice and include Federal Tax where applicable.

Kodak
TRADE-MARK

Your Kodak dealer stands ready to help you get better pictures. Talk with him every chance you get.

EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

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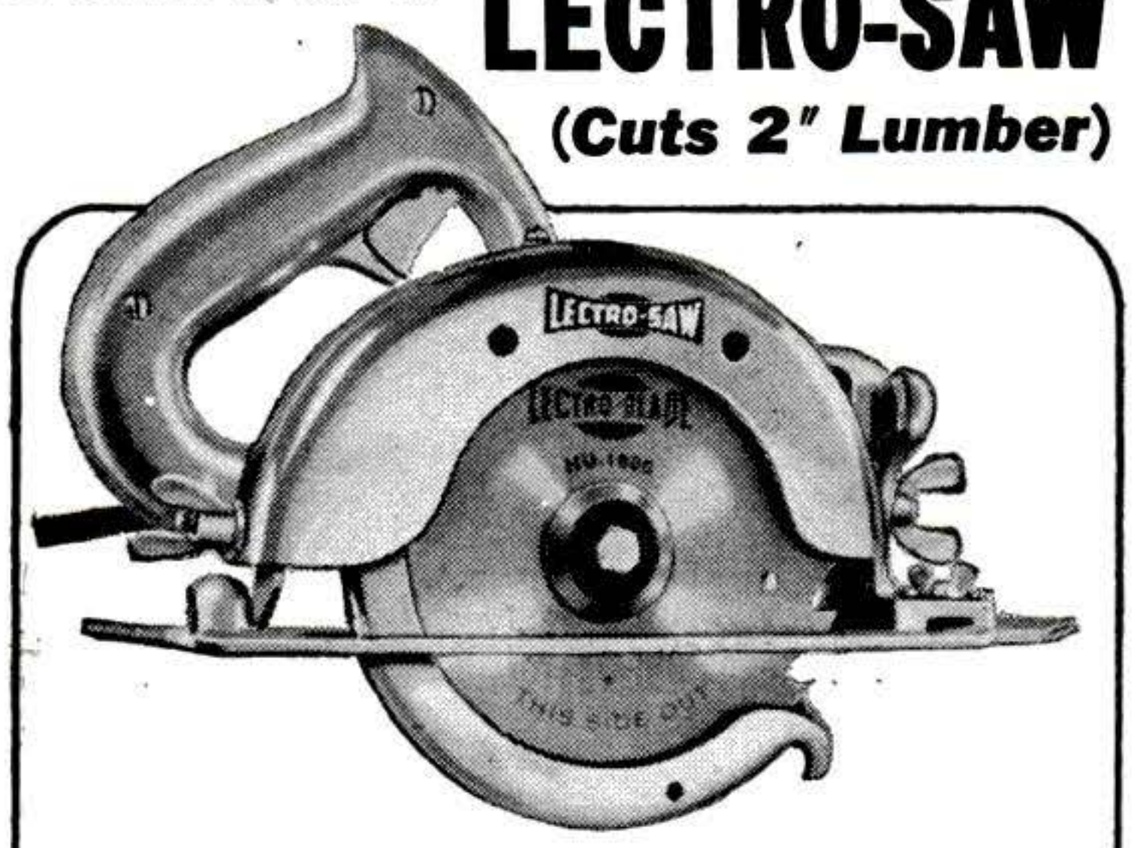
NEW! 6″ Heavy-Duty Deluxe LECTRO-SAW

(Cuts 2″ Lumber)



Fast Adjustment! Quick-changing, built-in depth and bevel adjustments permit cuts from 0″ to 2″ depth; bevels from 45° to 90°.

Power! Powerful universal motor specially designed and built by Black & Decker for non-stop, trouble-free power sawing.

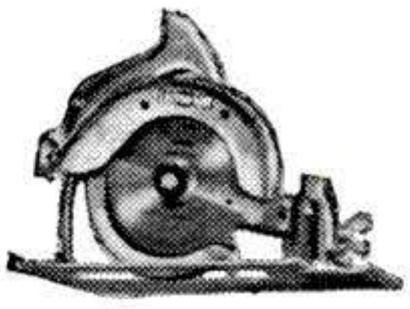
Versatility! Makes most every cut in most all building materials with proper Lectro-Blade or Abrasive Disc.

Safety! Telescoping blade guard. Instant-release trigger switch. Saw-grip handle positioned for safe, easy control.

What speed! What savings! WHAT A BUY for only $76.50!

Cut hours off your building jobs, save money and materials with a great, new 6″ Heavy-Duty Deluxe LECTRO-SAW! Beats hand sawing 10 to 1. Pays for itself in a few jobs. Close-coupled, perfectly balanced, easy to control. Extra-long life because of dependable motor, full-size ball bearings, high-quality helical gearing, hardened armature shaft, husky housings. Try one at your hardware or building supply dealer.

Bevel Adjustment Quadrant



Two Depth Adjustments (front and rear)

ELECTRIC LECTRO-SAW SAWS

Products of HOME-UTILITY Div., BLACK & DECKER Mfg. Co., Dept. H6S, Towson 4, Md.

Gus Solves One for the Judge

[*Continued from page 160*]

that distributor a thorough going over and that's going to take time. I'll drive you home tonight and give you a ring in the morning after I've done a little checking."

The Judge agreed, and after Gus had locked up the office and the shop, the two men drove off in Gus's car.

When Gus got to the Model Garage the next morning, Stan was already there, and Gus noticed that Judge Tate's car had been moved to another position on the floor.

"Have any trouble getting that car started, Stan?" Gus asked, indicating the Tate car with a nod of his head.

"No, should I?"

Gus grinned. "Ever seen that car before?"

At that point, Stan did a double-take. "Why, it's the Tate's car," he groaned. "When was it brought in?"

"Last night, after you'd left. Old Judge Tate himself brought it in. Seems he has had the same sort of trouble Mrs. Tate had that time you fixed it." Gus chuckled.

"Okay, boss," said Stan good naturedly. "Rub it in. What do I do now?"

"First of all, let's check the distributor. Something's making that cap pop off under certain conditions. The two spring catches are a bit loose. Could be that the contact spring on the top of the rotor has been bent up enough to force them loose."

Gus reached in, unlatched the cap, and lifted the rotor off the shaft. "First, let's get a new rotor out of stock and replace this old one."

Lifetime Job

Gus replaced the old rotor and put the cap back in place. "Now," he told Stan, "your job is to sit in the driver's seat and start and stop this engine at about five-minute intervals until something happens."

"A fine way for a guy with ambition to earn a living," Stan joked as he slid in under the steering wheel. "I could be here doing this for days."

As Stan intermittently worked the starter button and the ignition switch on the Tate's car, Gus busied himself with another job. When nothing had happened after 40 minutes, Gus was about to tell Stan to quit when a hollow "pop" resounded through the shop. Gus dropped the pliers he'd been using and made it on the double over to the car. By the time he got there, Stan was

[*Continued on page 212*]

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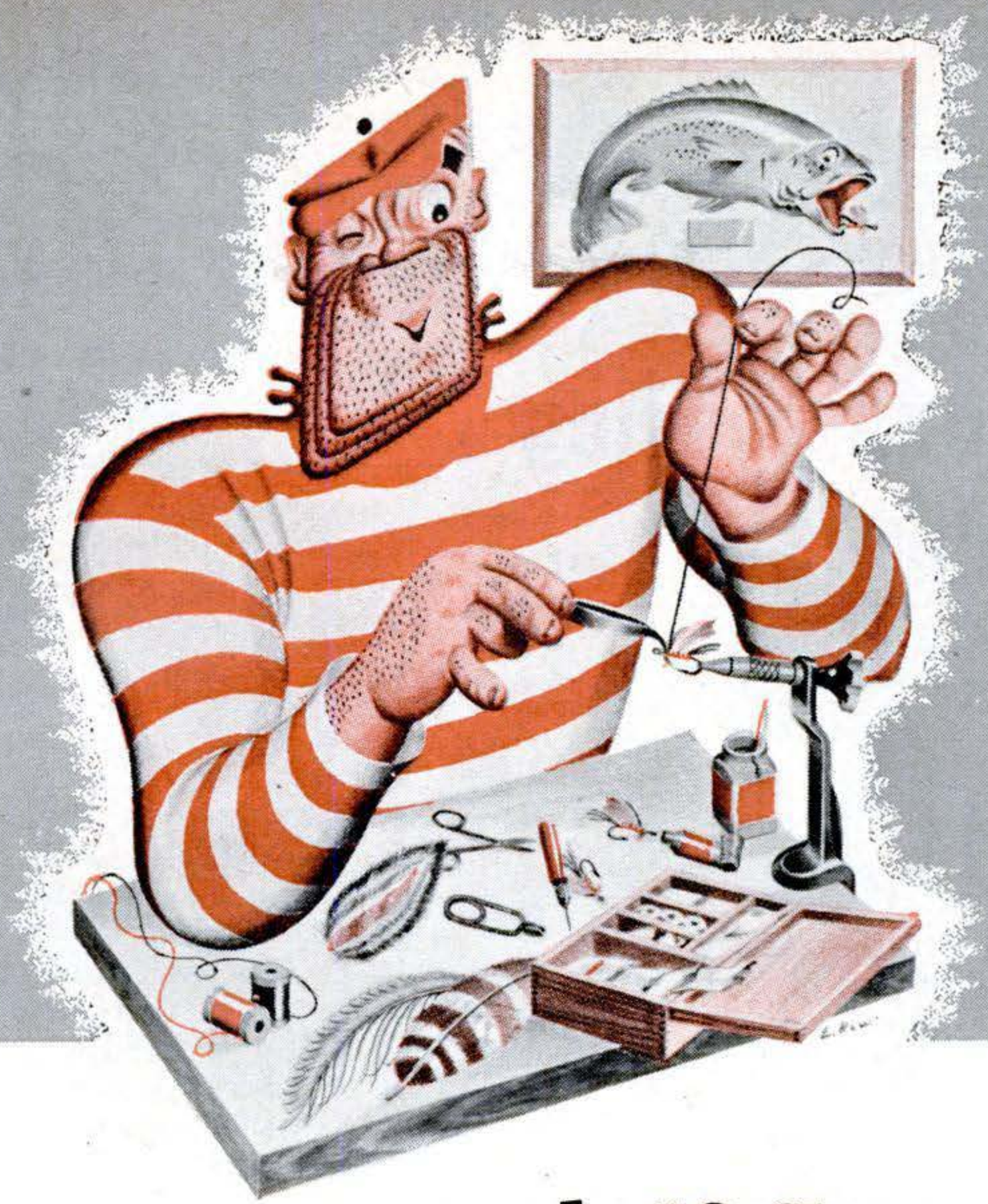

TOUGH...but oh so gentle

TOUGH ON OIL-PUMPING • GENTLE ON CYLINDER WALLS

Using too much oil? Chances are, your piston rings are worn-out and they're not only wasting oil, they're wasting power—and causing needless engine wear.

Fortunately, worn-out piston rings can be replaced economically, but the more you delay the more you pay.

At the first sign of oil-pumping, replace your rings with Hastings piston rings. They're engineered for replacement service exclusively. They *stop* oil-pumping, *check* cylinder wear, *restore* engine performance. It's the best money you can spend on your car.

HASTINGS MANUFACTURING COMPANY • HASTINGS, MICHIGAN
Hastings Ltd., Toronto

Keep your car out of the DANGER ZONE

Ask your motor service man for a Danger Zone check-up. Write for the free Hastings Danger Zone Booklet which shows you how to save money on engine repairs. Address Dept. P.

HASTINGS

STEEL-VENT PISTON RINGS

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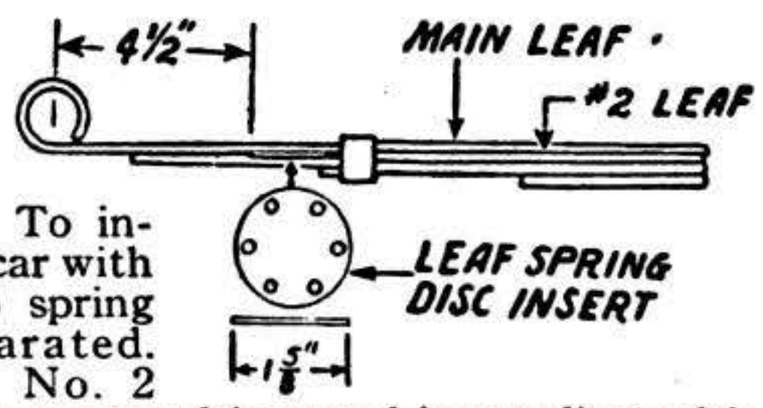
Care and Feeding of Engines

BY S. P. CORP

SLAP-HAPPY SPRINGS

Ever hear a slapping racket when you're driving over rough roads, especially in wet weather? Slap-happy springs! Lubrication won't fix it, but a plate-type disc inserted next to the main leaf of each rear spring will quiet it down. Most service stations sell these discs. To install, lift rear of car with bumper jack so spring leaves are separated. Pry main and No. 2 leaves apart with a screwdriver and insert discs with smooth side down. If springs are covered, cut a 2½" slot in side of cover, 4½" from each end of spring and insert discs. Then peen over the slot in the cover. This should remove cause of slapping.



MORE ABOUT TIRE CARE

Now that the air is full of rumblings about rubber shortage and synthetic tires, let's talk some more about making tires last longer. It's a good rule to stop at a service station at least once a week to have tire pressure checked.

While you're doing this, inspect the tire-wear pattern.

A tire that shows wear on the outside edges indicates underinflation. To avoid this, *never check a hot tire.* There is a normal build-up of 3 to 5 pounds over recommended tire pressures as the tire gets hot while being driven.

Never bleed a built-up tire pressure. This built-up pressure prevents excessive sidewall flexing, a cause of tire-damaging heat. A tire carrying 24 lbs. may get up to 27 lbs. under normal driving, or 29 lbs. at high speed. This is normal build-up. Such pressure should not be bled while tire is hot.

On the other hand, center tread wear means overinflation, and that, too, may shorten tire life. Keep pressures correct, and rotate tires every 2500 miles.

RE-RING FOR SUMMER

To get full enjoyment from your summer vacation trip, put in new Sealed Power Piston Rings now—save gas, save oil, and get the thrill of restored power! The Sealed Power MD-50 Steel Oil Ring is the best oil control ring ever built—the only ring with the Full-Flow Spring. Controls oil even in badly tapered and out-of-round bores.

Ask for free booklet, "7 Ways to Save Oil." A card will bring it—just address Sealed Power Corporation, Dept. H-6, Muskegon, Michigan. For triple wear, get Sealed Power Chrome-Faced Rings.

Gus Solves One for the Judge

[Continued from page 210]

standing beside the open hood scratching his head. Everything that Judge Tate had said had been true. There was the distributor cap hanging loose at the end of the ignition wires.

Gus bent down to get a closer look at the distributor and cap. "What do you know? Knocked clean off. It couldn't have been the rotor. And that loud 'pop'."

"You know, Gus, that 'pop' sounded just like a carburetor backfire," Stan suggested. "You know, the kind you sometimes get when you try to start a motor on a real cold day with the mixture set too lean."

"Stan, I think you've got something," agreed Gus. "Hold the fort while I make a phone call."

As Gus disappeared through the office door, Stan shook his head. "Now how could a backfire in a carburetor knock the cap off a distributor?" he muttered to himself.

When Gus reappeared he was holding a short length of rubber tubing of the sort used with windshield wipers. And judging from the pleased look on his face, Stan felt certain that the boss was hot on the trail of some sort of clue.

"Just on a hunch, I'm going to check the vacuum spark-advance unit on that distributor," Gus explained. "Get a wrench and take off the vacuum line at the distributor."

Hunch Pays Off

As Stan went to work, Gus elaborated. Many distributors, he explained, are fitted with a diaphragm, operated by the vacuum generated in the intake manifold, that automatically retards the spark when the engine is pulling a heavy load, as in going up a hill.

When Stan had unscrewed the vacuum line at the distributor, Gus slipped one end of the rubber tube over the open fitting, put the other end in his mouth, and sucked in. Whatever he found, it seemed to please him.

"We're on the right track, Stan. Let's install a new vacuum unit and I think we'll have cured Judge Tate's exploding distributor."

In a few minutes the new vacuum unit was in place. Gus was standing near his bench stoking up his old pipe. Stan was rubbing his hands on a piece of waste.

"Let me in on a secret, will you?" Stan asked with a grin. "I still don't understand

[Continued on page 214]

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"TOP 3" for fishin' fun

[most for your dollars, too]

BIG TWIN
25 H.P.*
Leader in performance, features, value! Roto-Matic Control, Gearshift, Cruis-a-Day Tank.
$390

FASTWIN
(on boat above)
14 H.P.* Only 65 lbs.
Up to 22 miles on good-sized fishing boats. Gearshift, Cruis-a-Day Tank.
$315

FLEETWIN
7.5 H.P.* Only 45 lbs.
Tops in lightweight field! Duo-Clutch gives "press-the-button" handling ease. Safti-Grip Drive.
$210

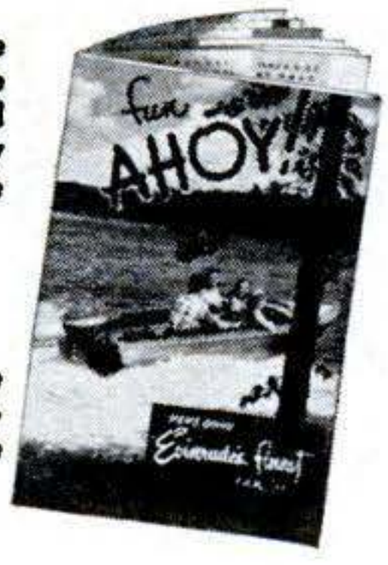
TOO GOOD TO MISS! . . . the keen new thrills these great Evinrudes bring to fishing fun! *The thrill of speed* to make long runs in a fraction of the time! (With Big Twin, up to 30 miles an hour on comfortable fishing boats). The matchless convenience of Gearshift and Duo-Clutch! *New handling ease . . . and,* with Big Twin's and Fastwin's Cruis-a-Day Tank, carefree hours of running without re-fueling!

All this and trolling, too! Yes . . . even Big Twin, with its eager 25 horsepower, throttles down to a slow and steady gait that wins the most finicky fisherman! Dollar-wise, compare them against the field—for power, performance, features, *fun*—and you'll want to get your order in! *See your Evinrude Dealer*—look for his name in your phone directory under "Outboard Motors." *Catalog Free*—write for it today!

*Power ratings are O.B.C. certified brake H.P. at 4000 R.P.M. All prices are F.O.B. Factory and subject to change without notice.

OBC

CATALOG FREE! Write today for full-color catalog of complete Evinrude line for 1951.



EVINRUDE MOTORS
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In Canada: Evinrude Motors, Peterborough, Ontario

EVINRUDE

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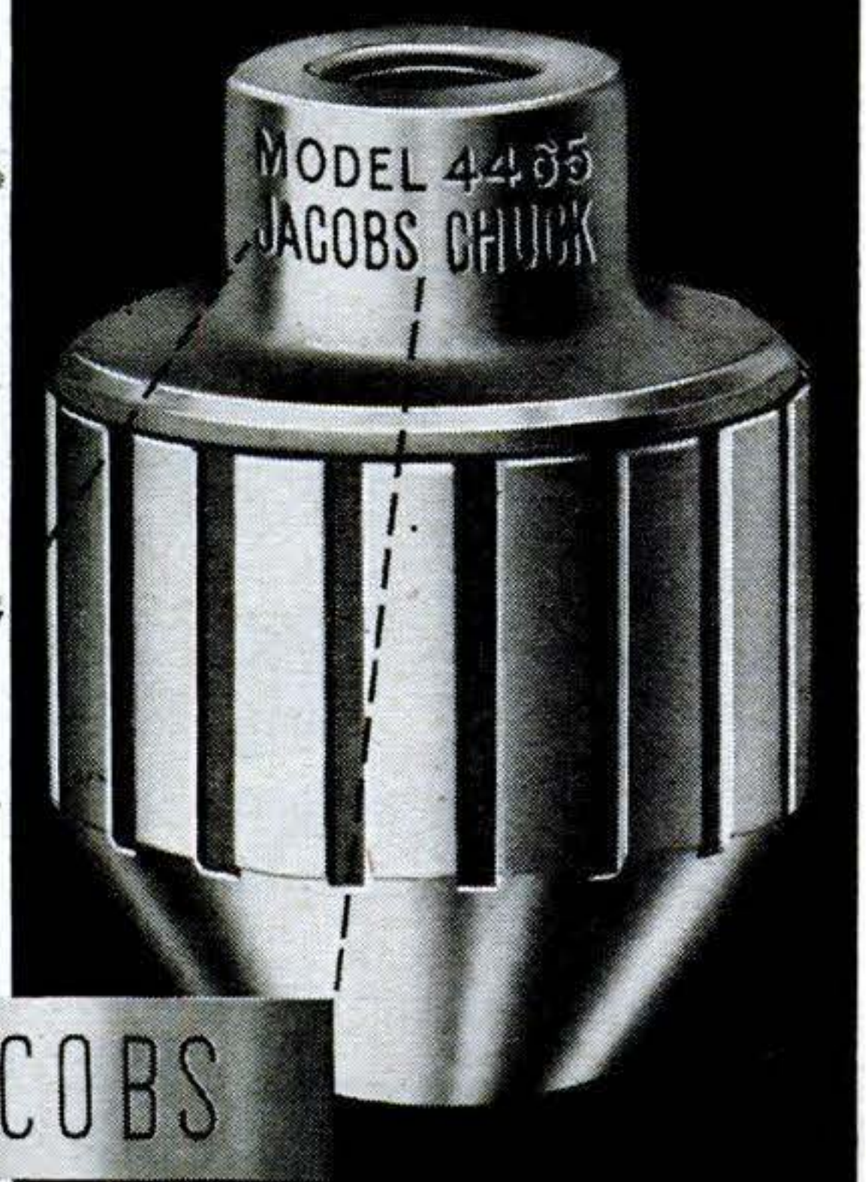
YOU CAN TELL A GOOD ELECTRIC DRILL BY ITS CHUCK



JACOBS

If it's a JACOBS
It bears the name... look for it!

Jacobs Rubber-Flex Hand-Tite Chuck. One-piece RUBBER-FLEX jaw assembly holds tools true and tight. No loose jaws or springs.

Jacobs Plain Bearing Key Chucks . . . the most widely used drill chuck in the world.

Jacobs Rubber-Flex Hex-Key Chucks on home workshop power tools prove that their makers put quality first.

IF IT'S A

JACOBS

IT HOLDS

The Jacobs Manufacturing Company
West Hartford 10, Connecticut

Gus Solves One for the Judge

[*Continued from page 212*]

why that distributor cap kept popping off or why putting on a new spark-control unit is going to fix it."

"I don't wonder Stan," said Gus as he put a match to his pipe. "As a matter of fact, it's the first time I've run across this kind of trouble myself.

"You see," Gus continued, "that vacuum unit has a diaphragm in it that's operated by the suction of the intake manifold. When the diaphragm is pulled in by the suction, it operates a lever that rotates the breaker plate and automatically advances the spark. Well, the diaphragm in that old unit had a hole in it. I found that out when I slipped the tube on the fitting and sucked in."

"But why should that pop the distributor cap loose?"

"Well," Gus explained, "when the car was parked for a short time under certain conditions, enough gasoline vapors probably seeped back through that hole into the distributor to form a fairly explosive mixture. Then, when the starter button was pushed, there was enough arcing at the breaker points to touch the mixture off. Puff, a minor explosion, and the distributor cap was sprung loose from its catches."

Stan Turns Hero

"But what gave you the tip-off?" asked Stan.

"You did," said Gus. "Your crack about that 'pop' sounding like a carburetor backfire got me to thinking. Then I called the Judge to see how his car had been running. He cinched my hunch when he told me that the car seemed a little sluggish on the open road. That meant the spark wasn't being automatically advanced as it should under ordinary running speeds. And that could only mean that the diaphragm in the vacuum unit wasn't doing its job. By all odds that, in turn, meant a leaky diaphragm. And a diaphragm with a bad leak could let enough gas fumes seep back into the distributor to cause trouble now and then."

"Well," said Stan, "I'm glad we don't get a toughie like that one every day."

"But if it weren't for those toughies," said Gus, "the garage business wouldn't be much fun. I'd go nuts just pumpin' gas, fixin' flats, and drainin' out antifreeze. They're the cream in the coffee."

"Well, if that's the case, boss, I'll take mine black." END

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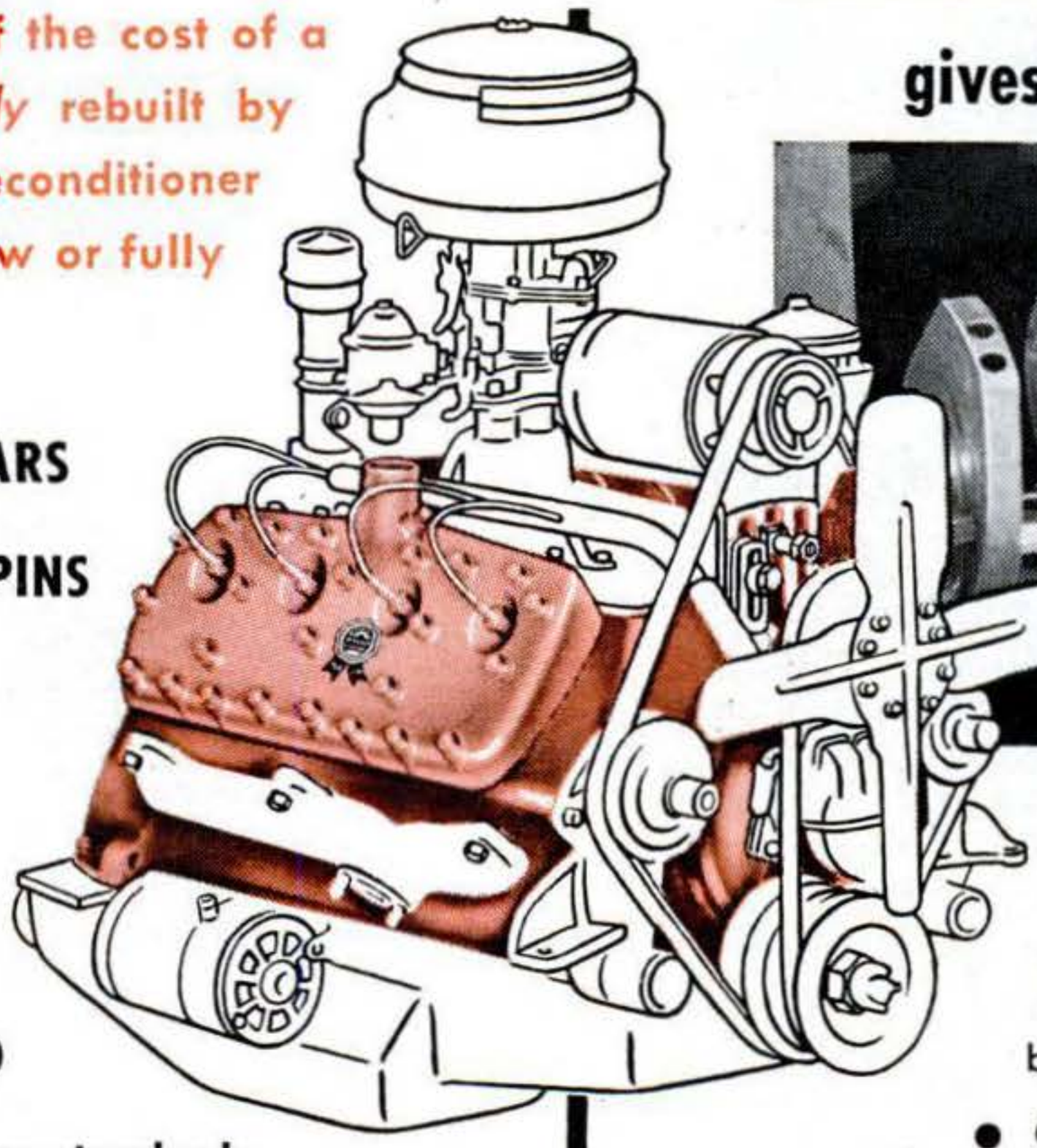

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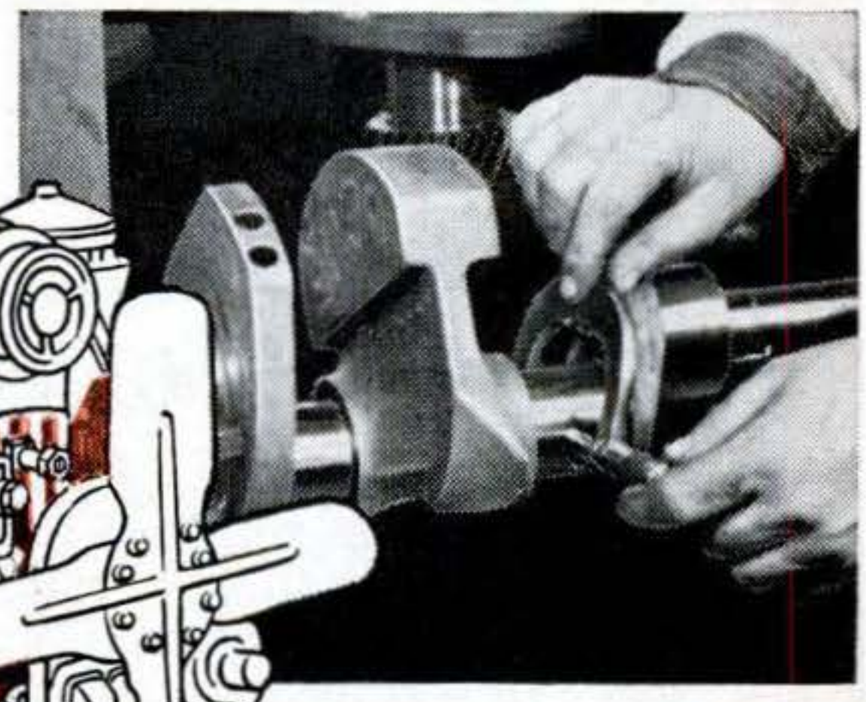

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Cortisone Saved His Life

[*Continued from 100*]

matic fever, a common crippler and killer of children that accounts for about a third of the nation's heart-disease deaths. Tough scar tissue forms on inflamed heart valves. It contracts or "shrinks" as it grows, twisting the valves so that they fail to provide a perfect fit in the heart chambers. The valves leak and blood rushing past produces characteristic heart murmurs.

A case studied at the Mayo Clinic suggests that the hormones sometimes repair deformed heart valves. The patient, a 15-year-old high school girl who "ached all over," had a high fever and an unusually fast pulse rate. Four days after the first dose of cortisone, all her symptoms disappeared. Far more significant, however, the abnormal heart sounds also vanished—indicating that the valves were back in working condition.

The gland extracts are being used for an increasing number of chronic diseases. Patients blinded for months by progressive iritis, a severe inflammation of the eye, have been able to read fine print after a week of cortisone or ACTH. And medical research on the drugs is just beginning. They have already been tested in treating more than 50 diseases and the list will grow as larger supplies become available.

Not Really Cures

It's estimated that 150,000 to 200,000 patients have received the hormones to date. But medical researchers still refuse to speak of "cures" or "treatments."

Says Dr. Hench of the Mayo Clinic: "ACTH and cortisone do not put out the fire, but they do provide an asbestos suit." There's no doubt about the beneficial effects in acute rheumatic fever, severe burns, and other conditions that may heal themselves after a while. The drugs not only relieve pain, but often speed recovery.

But a patient's arthritis may last 60 years, and the hormones don't appreciably affect the mysterious processes *causing* the disease. Some doctors find that cortisone loses some of its effect on a patient after six months to a year of use. They believe that the new drugs will supplement—but not replace—the older treatments. Other specialists point out the most valuable use may be for patients whose arms and legs are twisted into awkward positions. The limbs are usually so tender that they can't be moved, but

[*Continued on page 218*]

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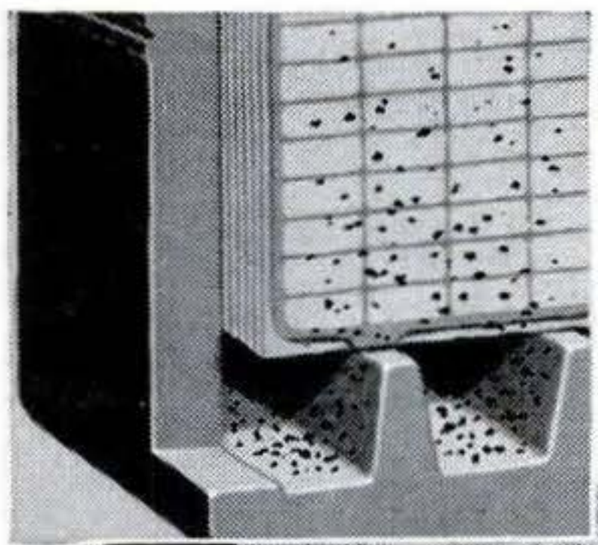
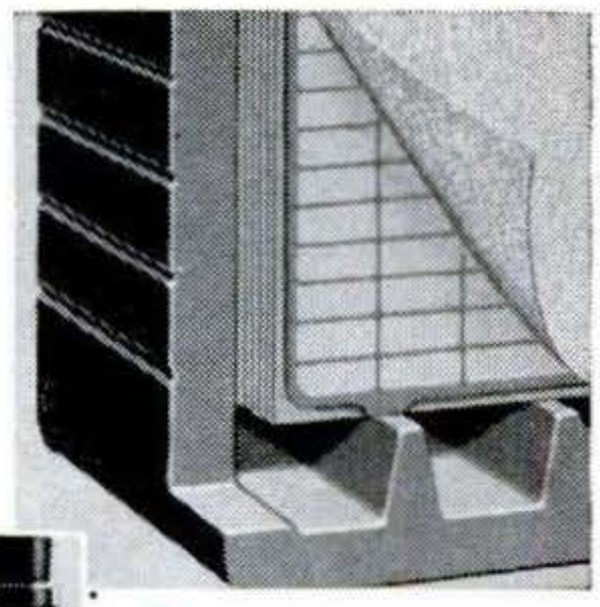
The inside story of your battery-

See how it works!

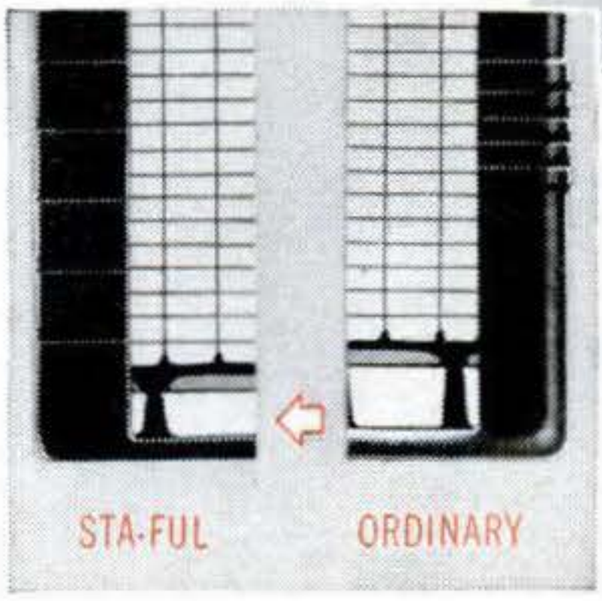


1 In ordinary batteries, small particles keep flaking off positive plates, so ordinary design batteries must have large sediment wells at bottom of case to hold these particles.

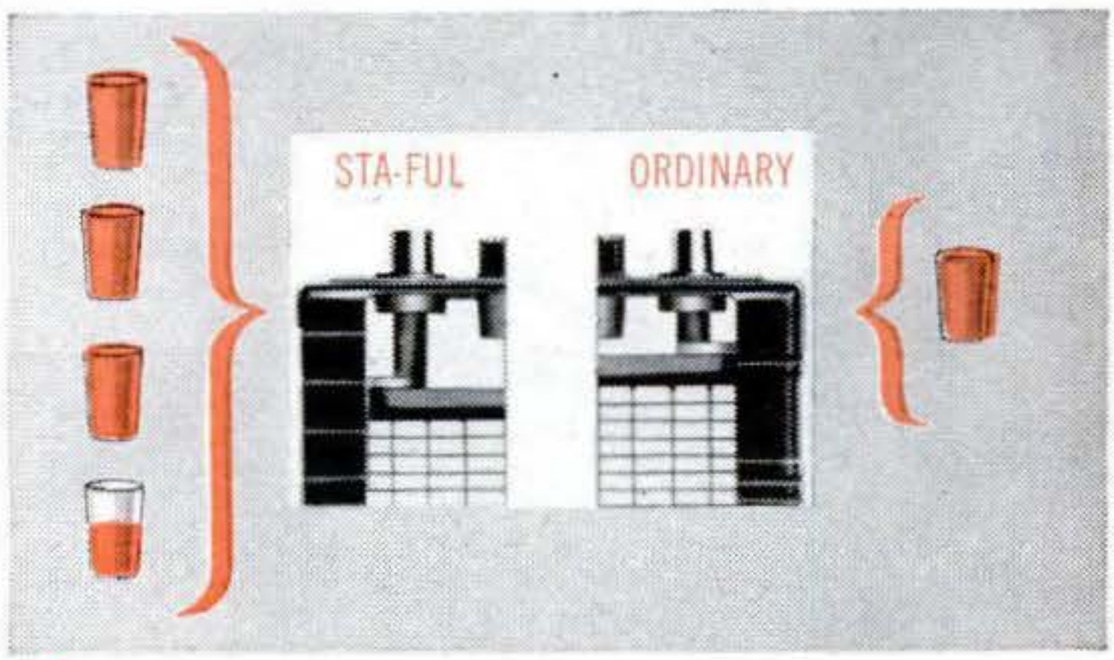
2 If sediment wells in ordinary design batteries aren't big enough to hold flaking particles from positive cells, particles pile up and short circuit cells, causing cell failure.



3 In the Auto-Lite "Sta-ful" Battery, every positive plate has a Fibreglass retaining mat protecting it and holding the active materials in place to reduce shedding and flaking.

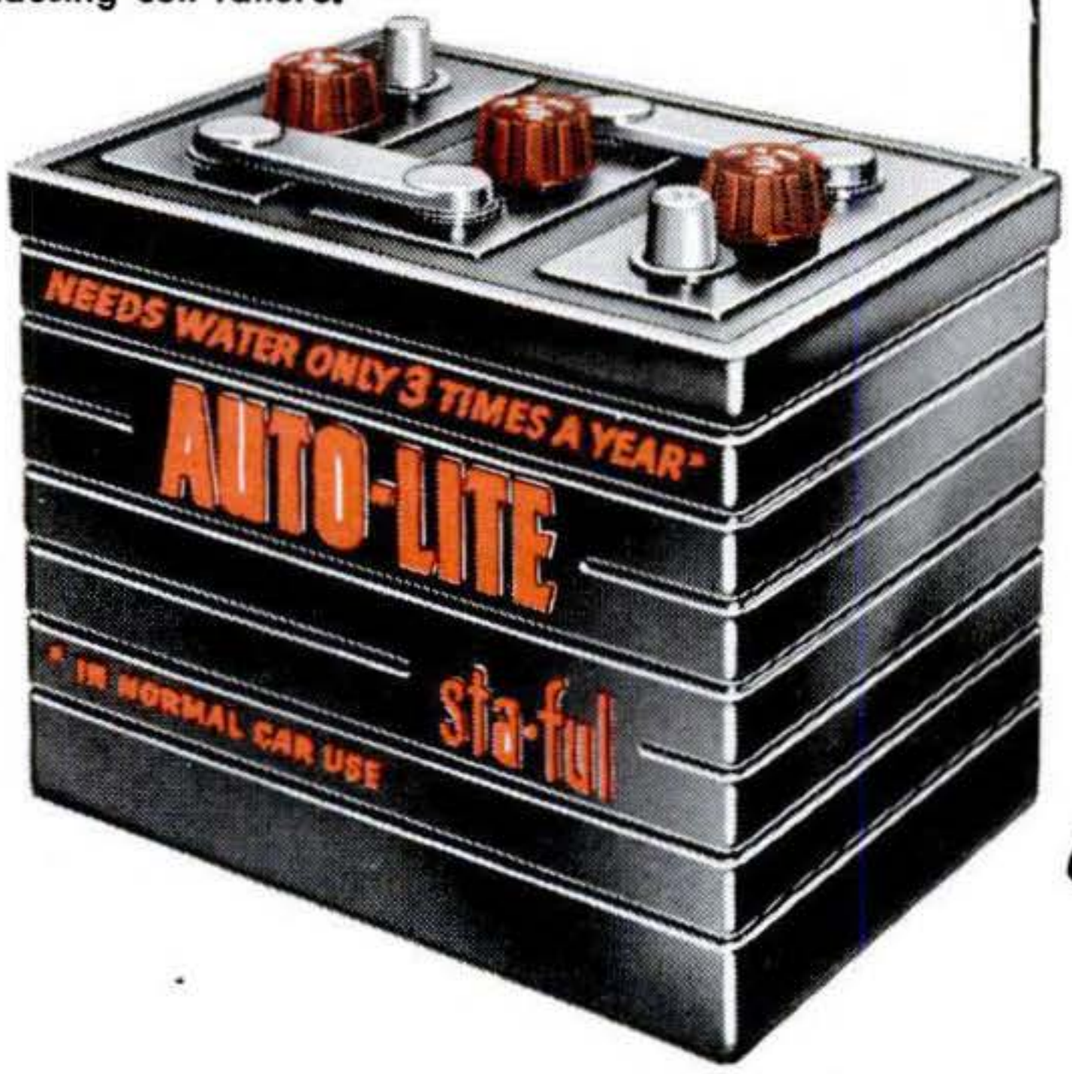


4 Side-by-side view shows that the "Sta-ful" Battery doesn't need all the extra space at bottom as ordinary design batteries do. So extra space in "Sta-ful" Battery is moved to top where . . .



5 . . . extra space can be used to hold more battery electrolyte, giving room for *over 3 times the liquid reserve* in the "Sta-ful" as in ordinary batteries. That's why the "Sta-ful" needs water only 3 times a year in normal car use. "Sta-ful" Batteries give longer life, too, in tests conducted according to minimum life cycle standards.

AUTO-LITE BATTERY CORPORATION
Toledo 1 **Ohio**



Auto-lite sta-ful *...needs water only 3 times a year*

IN NORMAL CAR USE

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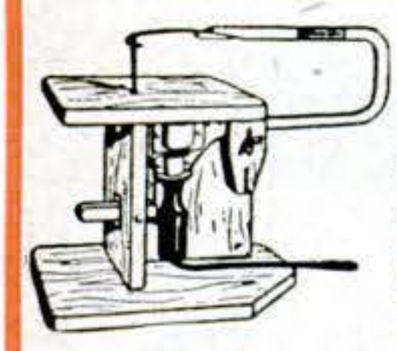

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Cortisone Saved His Life

[*Continued from page 216*]

cortisone reduces pain and inflammation long enough for massages and other muscle-building treatments.

And there's one point that mustn't be overlooked. No modern drugs have so many bizarre and baffling effects, wanted and unwanted. How do ACTH and cortisone produce excess hair growth and a moon-shaped face? Why do they increase the multiplication rate of tuberculosis germs—and at the same time prevent the disease from spreading in early stages? Doctors can't explain these facts nor say why the hormones may relieve the symptoms of hives, asthma, and assorted allergies within six hours—and chase hangovers in 30 minutes.

Considerable research is under way on what is perhaps the most intriguing effect of all. Cortisone and ACTH are potent "pep" preparations. Patients experience a marked mental lift after the first doses. They sleep only four or five hours a night, and don't seem to mind it. The elation vanishes after a few weeks, but it has to be watched carefully. Unless doses are controlled, patients may even develop psychotic manias.

Hormones May Be a War Weapon

Department of Defense scientists are conducting secret studies of the hormones. The research that led to the large-scale production of cortisone started early in World War II, when it was rumored that Nazi pilots were using adrenal extracts to fortify themselves for high-altitude flights. The rumors turned out to be false, but the idea hasn't been abandoned. There's plenty of evidence that cortisone and ACTH increase resistance to cold, fatigue, and other forms of stress—and they may play a vital role in warfare.

The most important question of all—how the hormones work—hasn't yet been answered. But the very fact that cortisone and ACTH produce so many different effects may be a valuable clue. Substances that work on everything from ailing hearts and hangovers to the state of your mind clearly involve basic metabolic reactions. Biologists are just beginning to outline a theory.

Here's what *may* happen when cortisone reduces the swelling in a joint. The accumulated debris of cells and immobilizing tissue is broken up and washed away in the bloodstream. The chemical industry carries out somewhat similar "cracking" reactions in

[*Continued on page 220*]

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An Invitation to Every American Who Has an Idea for a Better Petroleum Product

To encourage progress, The Sinclair Plan will open the doors of the company's great petroleum laboratories to the best ideas of inventors everywhere.

INVENTIVE Americans are often hamstrung today because of a need for large and expensive facilities to find out if and how their ideas work.

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The Sinclair Plan. Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have sufficiently good ideas for better petroleum products.

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If the laboratories select your idea for development, they will make, in most cases, a simple deal with you: In return for the laboratories' investment of time, facilities, money and personnel, Sinclair will receive the privilege of using the idea free from royalties. This in no way hinders the inventor from selling his idea to other companies without further reference to Sinclair.

How to Participate. Instructions on how and where to submit ideas under The Sinclair Plan are contained in an Inventor's Booklet that is available on request. Write to: Executive Vice-President, Sinclair Research Laboratories, Inc., 630 Fifth Avenue, New York 20, N. Y. for your copy of this booklet. *Important:* Please do not send in any ideas until you have sent for and received the instructions.

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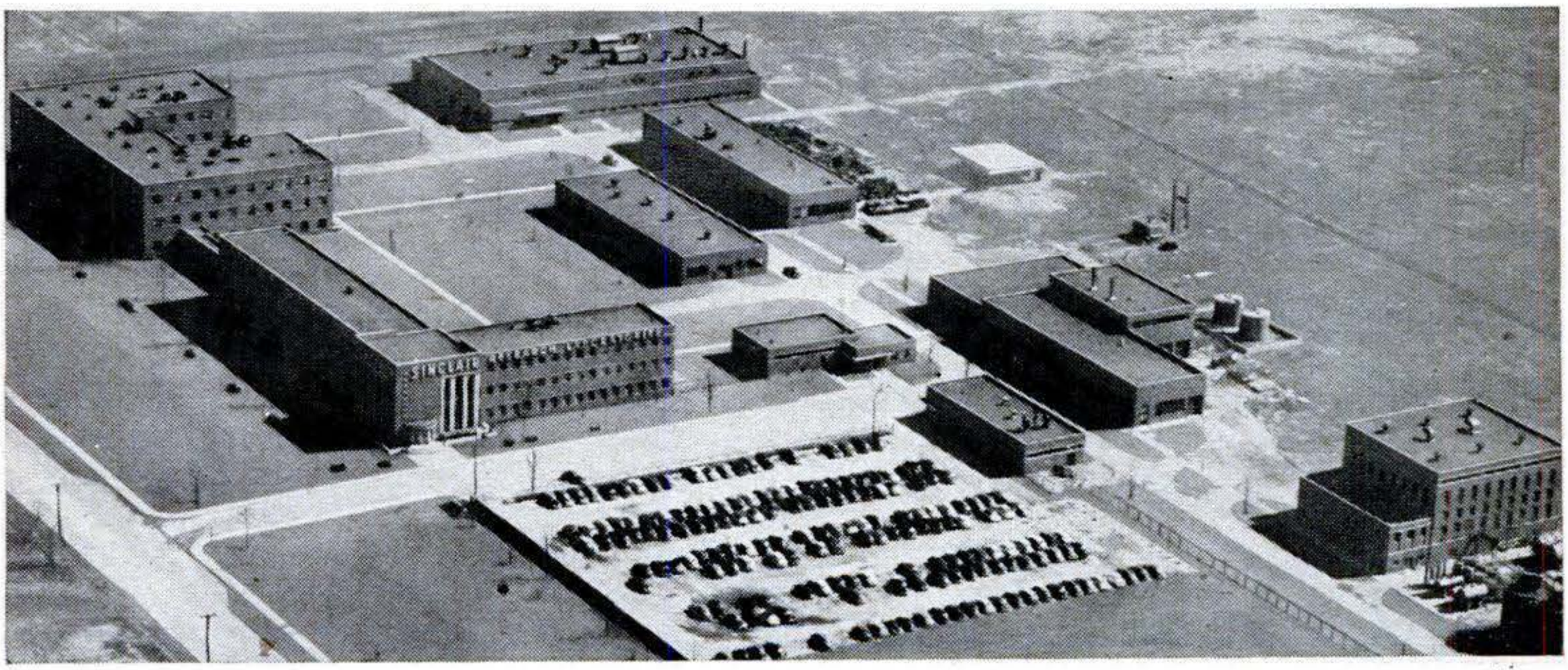

SINCLAIR RESEARCH LABORATORIES at Harvey, Illinois, have contributed many of today's most important developments in the field of petroleum. Under The Sinclair Plan, the available capacity of these great laboratories is being turned over to developing the promising ideas of inventors everywhere.

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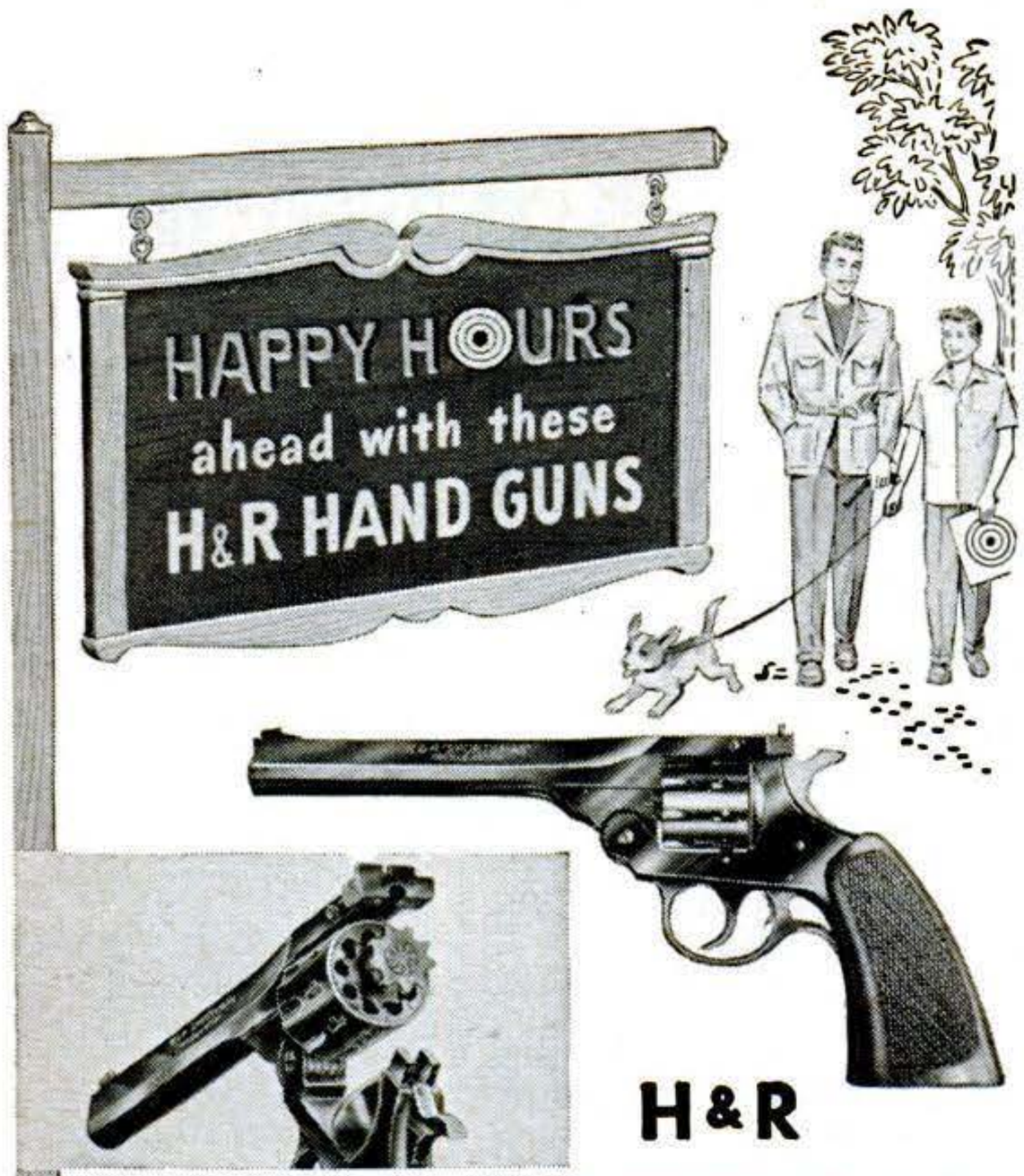

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Cortisone Saved His Life

[Continued from page 218]

high-pressure chambers and crucibles at more than 500° F. Nature does the trick without high temperatures, using enzymes. These chemicals speed the body's wrecking crews, and may be pictured as submicroscopic spheres with unique patterns of notches and dents in their surfaces.

The patterns are "locks"; the molecules to be broken up are "keys." These molecules slip into enzyme notches, forming a neat lock-key fit. Then the enzyme splits them and the pieces are released and carried away. A single enzyme particle may break up as many as 5,000,000 molecules a minute—when you're in good health. But sometimes unidentified substances accumulate and clog up the notches.

Normal processes slow down or grind to a stop when these natural accelerators are thus masked. Extra quantities of cortisone—administered directly or produced by ACTH injections—may unmask inactive enzymes by removing blocking agents. Then the body can dispose of cluttering material—and arthritic swelling subsides.

More Is Coming—Cheaper

ACTH is made from hog pituitaries, cortisone from beef bile juices. Chemists have been working overtime to increase yields. Three years ago Merck, sole manufacturers of cortisone, needed 300 cattle gall bladders to make five ounces of the white powder. The drug was produced by an intricate 37-step process and cost about $8,500 a gram—35/1,000 of an ounce. Now the process is a lot shorter and yields 30 to 40 times as much cortisone from the same amount of bile. The price is down to $30 a gram. But an arthritic patient may still pay two or three dollars a day for his tablets, and the demand still far exceeds the supply.

To obtain larger and cheaper quantities chemists are testing plants as well as animals for chemicals that can be built into cortisone. Promising substances have been extracted from soy beans, tomato leaves, and other vegetable sources. Researchers also hope to achieve "total synthesis." Another idea is to grow pituitary or adrenal glands in nourishing fluids. The living organs make ACTH and cortisone and can be "milked."

For all the unanswered questions, the hormones have been fairly described as "one of the most significant medical discoveries of our generation." END

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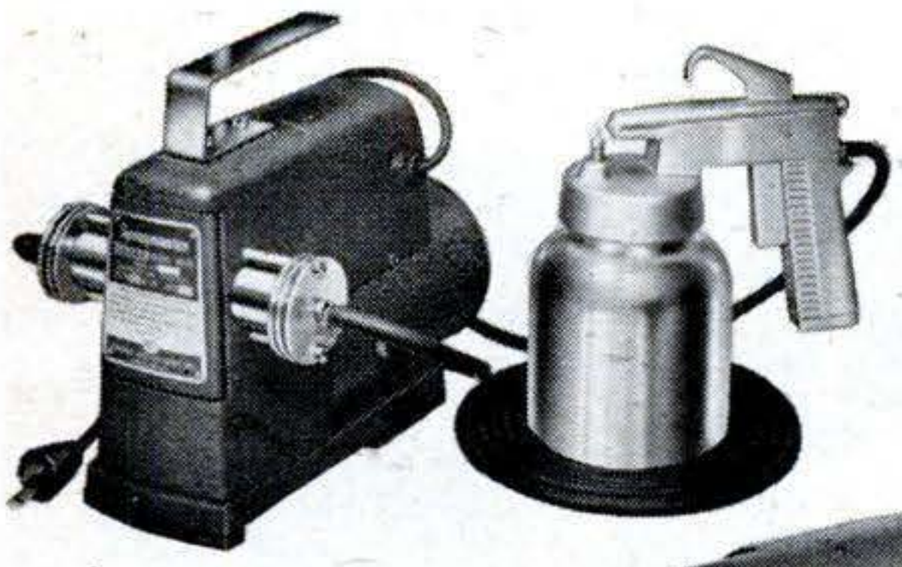

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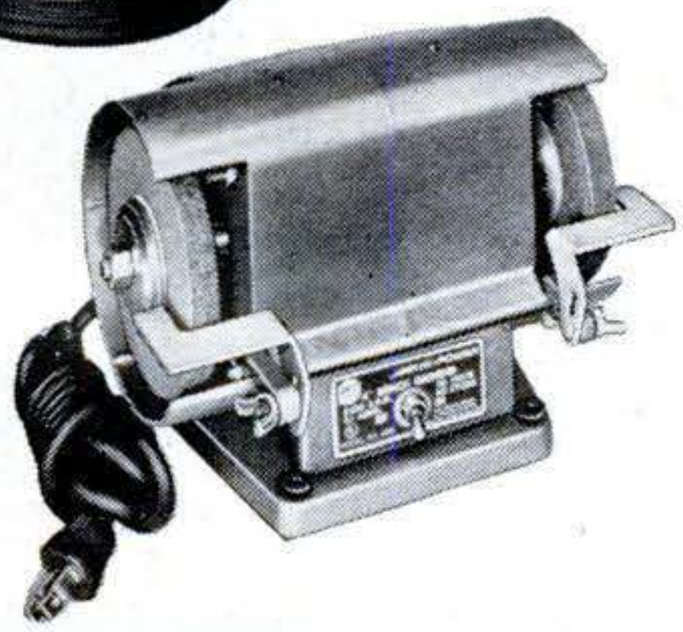

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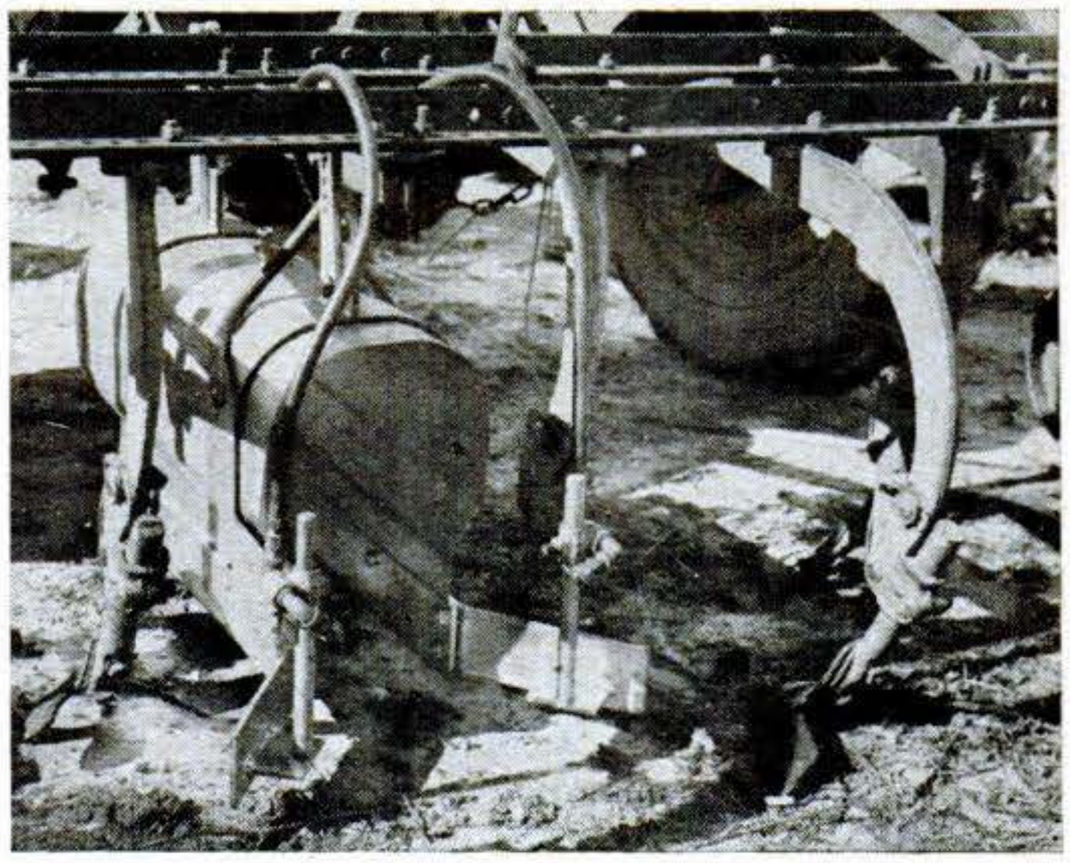
Mechanics of Farming

By Ladd Haystead

■ Chrysolina gemellata, an Australian beetle imported into this country in 1946, is eating himself out of existence on Klamath weed, a menace to Western ranges. The first colony imported has already cleared 100 square miles. Gemellata won't touch other plants. When all the Klamath is gone, beetle dies.

■ Deer (protected by law) are a menace to farm crops in Colorado County, Texas, where one farmer claimed he has not had a crop of sweet potatoes or peas for 10 years. Now the B. F. Goodrich Chemical Co. comes up with an answer--Good-rite z.i.p. When sprayed on crops, this chemical repels deer but doesn't harm them.

■ Hoeing cotton (and other southern crops) to control grass and



weeds has proved a big stumbling block to complete mechanization. Flame weeding offered great promise --but is not enough alone or in wet springs. Early weedicides killed pests all right--and cotton too. Then Mid-South Chemical Co., Inc., Memphis, Tenn., came out with its own private formula NO-HO. This chemical was successful if precision-placed, but there were no commercial machines for such placement. So the company devised its own (see photo above) with a hood that protects the delicate plants

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from damage by the machine itself and keeps clods from covering hills. Twin jets, mounted behind the hood and adjustable for either vertical or horizontal operation, spray out the weedicide on each side of the plant row. The weeder permits cultivation at plant emergence, eliminates four of the customary 11 sweeps on a two-row cultivator, and prevents too-close cultivation.

■ Guayule rubber is back in the picture. Ten years ago 30,000 acres were put under experiment, then dropped when synthetics succeeded. Current plans call for one million Texas acres to go into the crop.

■ Farm machinery has changed agricultural production in the last 100 years more than in the previous seven thousand. Anyone interested in how it was done should take a look at the 163 photographs in a new 68-page book just issued by the Farm Equipment Institute (608 S. Dearborn St., Chicago) called "Land of Plenty." In 1870, farmers commanded only 1.6 hp. per man as against 33 hp. today.

■ New self-propelled farm machine called the Uni-Tractor that can be either a combine or corn-picker is announced by Minneapolis-Moline (Minneapolis, Minn.). Other uses are being tested. Watch for a similar announcement from another company.

■ An electric calf-dehorner has been brought out by Lenk Mfg. Co., 30 Cummington St., Boston, Mass. It is said to permanently remove horn buttons, without bleeding or sores, in a quarter of the usual time.

■ Kin to artificial insemination is artificial pollination from University of California, Davis, Calif. A perforated screen trap scrapes pollen from legs of bees as they pass through the screen to the hive. Life of pollen has always been extremely short--a few hours. Now scientists rush it to a quick freezer, where it is kept at minus 51° C. by adding 40 pounds of dry ice a week. In tests, 96 percent of the fruit flowers pollinated in this way set after 12 months storage of the pollen.

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MASTIC TILE CORPORATION OF AMERICA

Member Asphalt Tile Institute

Factories:
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For faster cleaning . . . more beautiful asphalt tile floors, always use MA-TI-CO Wax and MA-TI-CO Cleaner.

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Please send complete install-it-yourself instruction kit, illustrated literature and color charts. Enclosed is 10c to cover mailing.

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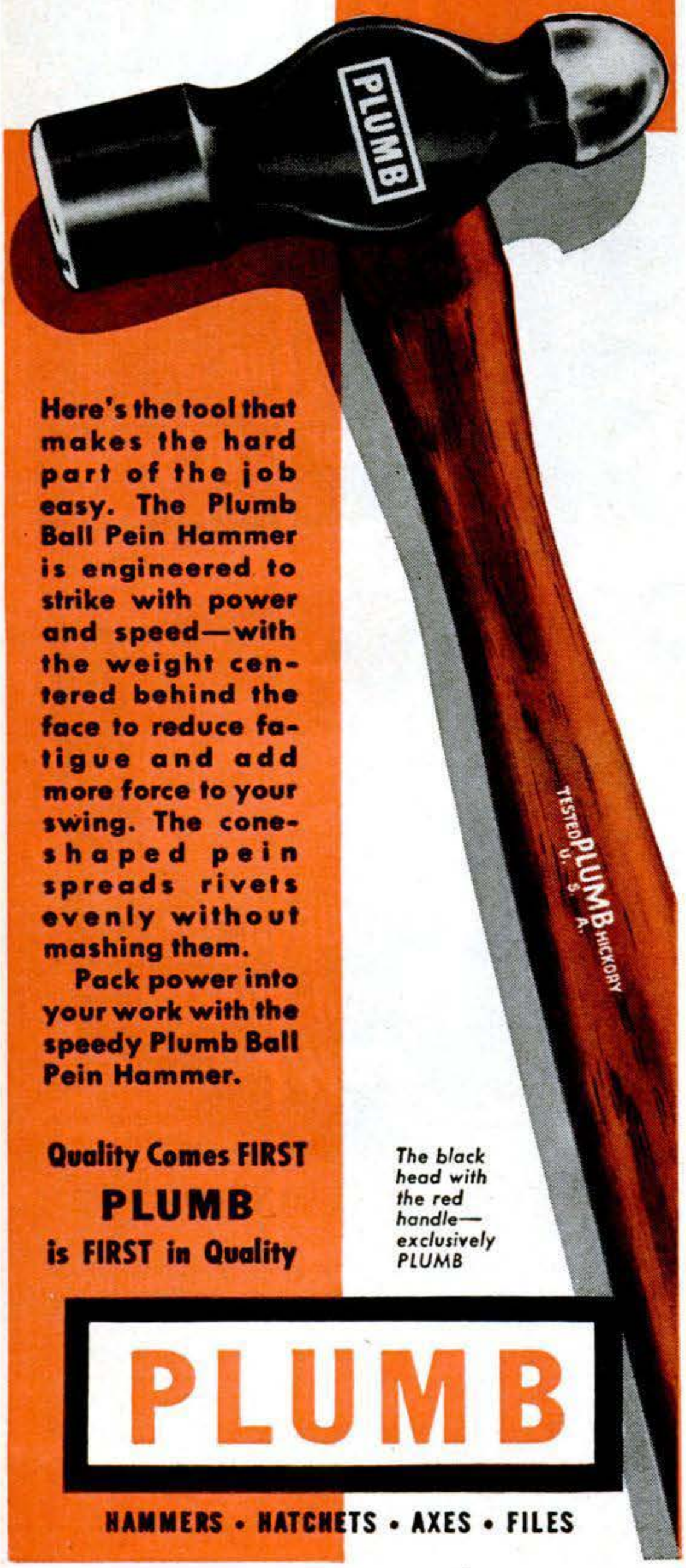
POWER *and* SPEED

Power and speed distinguish the modern carrier—a combination of air and sea might.



Here's the tool that makes the hard part of the job easy. The Plumb Ball Pein Hammer is engineered to strike with power and speed—with the weight centered behind the face to reduce fatigue and add more force to your swing. The cone-shaped pein spreads rivets evenly without mashing them.

Pack power into your work with the speedy Plumb Ball Pein Hammer.

Quality Comes FIRST

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The black head with the red handle—exclusively PLUMB

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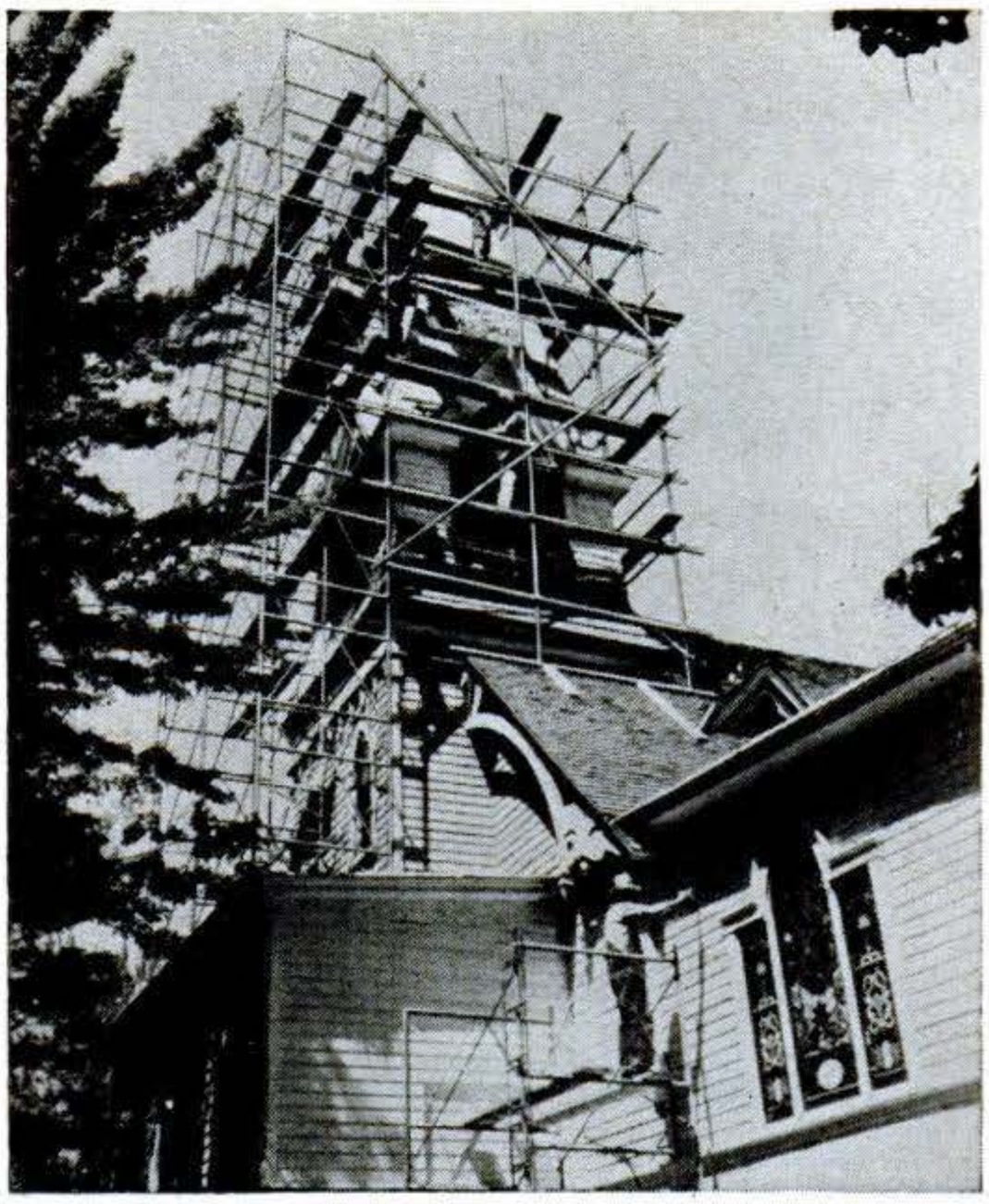
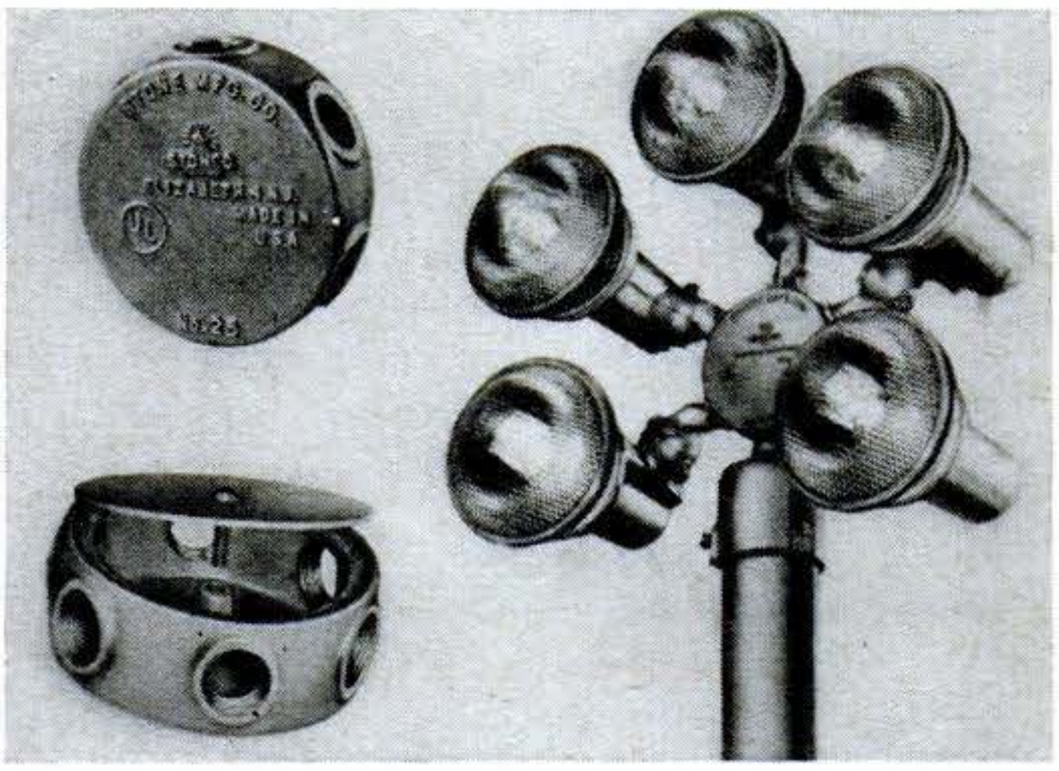
HAMMERS • HATCHETS • AXES • FILES



Clamps and Tubing Make Scaffolding

No SPECIAL tools are needed to erect this scaffolding. An ordinary wrench will tighten the clamps on the seamless aluminum or steel tubing. Both stationary and swivel clamps are used. The stationary clamps hold two tubes back to back and at right angles. Swivel clamps hold two tubes back to back but at any angle so that tubes serve as diagonal braces tying horizontal and vertical members together. Safway Steel Products, Inc., of Milwaukee, is the maker.



Floodlight Made of Aluminum Alloy

DESIGNED to conserve aluminum, this floodlight unit is die-cast of aluminum alloys. It is made by the Stone Mfg. Co., Elizabeth, N. J. The lamps in the cluster —150-, 200-, or 300-watt types—are wired independently.

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TRAINED VETERANS...

are cleared to come in!

That's right—you service-trained technicians have the opportunity to apply for valued U. S. Air Force ratings.

There are literally hundreds of Air Force position vacancies that must be filled by skilled men who need little or no refresher training. They will be initially assigned to a nearby Air Force Base.

If you have had technical schooling in any arm of service—you are the men your Air Force needs—*now!* In return, if you qualify, the Air Force offers you a rating in keeping with your previous military service plus your civilian experience.

Get full details at your nearest U. S. Army and U. S. Air Force Recruiting Station today!

SKILLS NEEDED NOW—Radio, radar, weather, camera repair, engine maintenance, gun turret maintenance . . . these are not all. Get a complete list at your nearest Air Force Base or Recruiting Station.

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Why do piston rings wear out if you use good oil?

If your piston rings were always protected by oil, they'd last longer. Unfortunately, when you start your car after long stops, it takes up to five minutes for oil to reach all vital parts. Meanwhile, dry metal grinds against dry metal. This DRY STARTING forms "Metal Ulcers" . . . causes most engine wear.

To stop it, use Miracle Power in your gas and oil. The colloidal synthetic graphite in Miracle Power clings to rings and cylinder walls . . . lubricates them until oil arrives. Actual tests show 49% less piston ring wear. Result—longer engine life . . . more power . . . more miles per gallon because of freer movement of parts. Next time you get gas, get Miracle Power.

Miracle Power Division

THE AP PARTS CORPORATION • TOLEDO, OHIO

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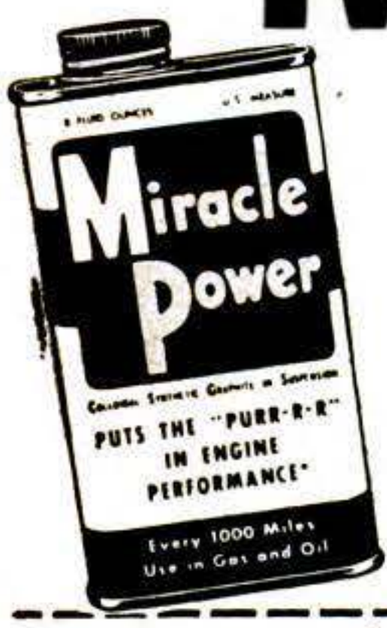

in gas and oil every 1000 miles—75c per can

Send for literature explaining how to make your car last longer. FREE

THE AP PARTS CORPORATION
672 AP Building, Toledo 1, Ohio

☐ Please send me FREE literature on making my car last longer.

☐ I want to prove the benefits of Miracle Power myself. Enclosed is check or money order for $1.50. Please send me 2 trial containers of Miracle Power *postpaid.*

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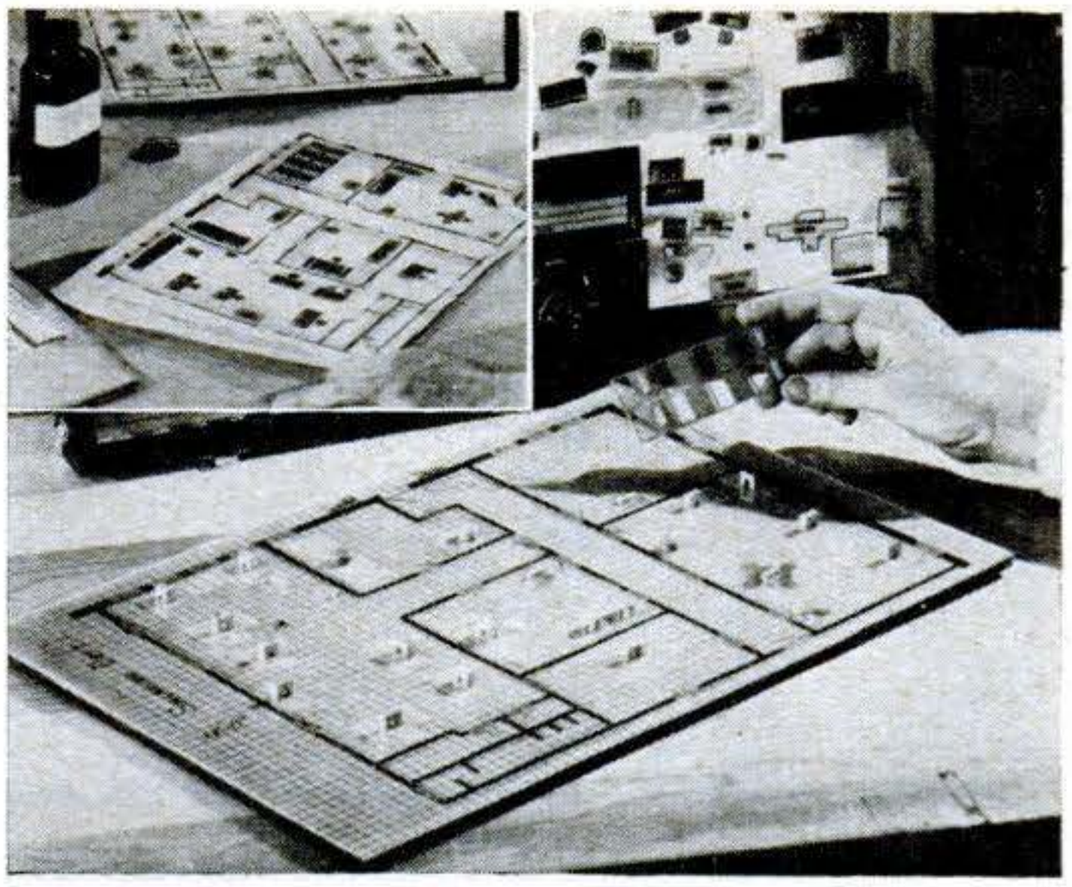
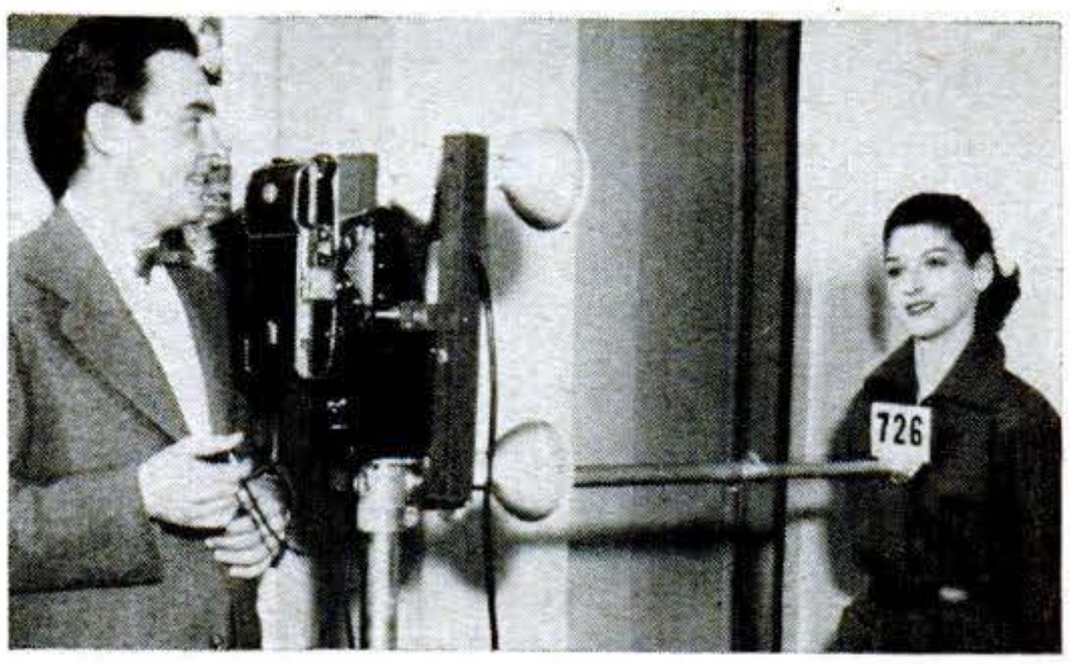


Kit Simplifies Floor Layout

ANYONE can now make an accurate scale floor layout and get a quick black-and-white print of the result. Plans for a room or any space are drawn on a graphed sheet of transparent Vinylite plastic. Then plastic units representing furniture or equipment are arranged. These are held down by small magnets. Sensitized paper is slipped under the plastic sheet, exposed to ultraviolet lamps in the carrying case, and swabbed with developing fluid. The result is the print shown in the inset. Gross Engineering Co., Three Rivers, Mich., makes the kit.

Identification Photos Made Quickly



THE Land-Polaroid self-developing camera has gone into the business of speeding up the taking of identification photos at military installations and industrial plants. A special Fairchild stereo attachment provides two pictures of the same person, one for use on a badge and one for the files. A shift enables two more pictures to be taken on the other half of the standard 3¼ in. by 4¼ in. Polaroid film sheet. When a frame has gone through the one-minute, one-step developing process, it is cut into four individual photos. To prevent over-developing, a built-in timer rings a bell at the end of 60 seconds.

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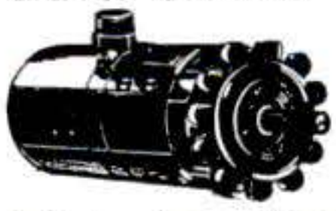
GROBAN'S WAR SURPLUS SPECIALS

ALL BRAND NEW — FULLY GUARANTEED

DIRECT CURRENT GENERATORS



For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #131—Brand new Electric Auto-Lite 12 volt Direct Current electric generators, rated 18 amps. Complete with blower and pulley. Use for trucks, tractors, boats, battery chargers, etc. Part No. GEF-4805A. In original sealed U. S. Army cartons. $40.00 value. Shpg. wt. 27 lbs. F.O.B. Chicago. Now Only..... **15.00**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't. Acq. Cost $300.00. Shpg. wt. 70 lbs. F.O.B. Chicago..... **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't Acq. Cost $380.00. Shpg. wt. 70 lbs. F.O.B. Chicago. Each individually packed in wooden box **35.00**

BYRON-JACKSON "PUP" CENTRIFUGAL PUMP UNIT

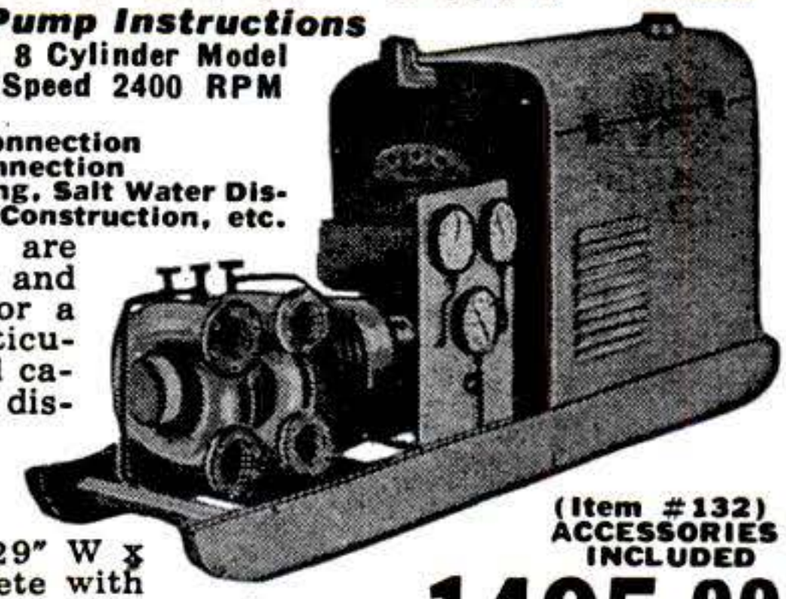
$3800.00 VALUE

Complete With Full Engine And Pump Instructions

2 Stage Model "PUP" Pump Driven by an 8 Cylinder Model C-36 Chrysler Industrial Engine. Engine Speed 2400 RPM —100 H.P.

600 GPM at 175 PSI—Parallel Connection
300 GPM at 375 PSI—Series Connection

IDEAL FOR: Pick-up, Gathering, Fire Fighting, Salt Water Disposal, Sprinklers, Irrigation, Dewatering, Construction, etc.



These skid-mounted Pumping Units are standard production models with parts and service readily available. Designed for a wide range of operating conditions particularly where wide variation in head and capacity are required. Twin suction and discharge ports are cast on the same side and so arranged that external piping is interchangeable for either parallel or series pumping applications. Overall dimensions, 114" L x 29" W x 62" H. Weight 4060 lbs. Now, complete with full priming equipment, operating instructions and performance data. F.O.B. Chicago.....

(Item #132) ACCESSORIES INCLUDED **1495.00**

Hydraulic Cylinders-Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #70—Purolator hydraulic oil filter. Permanent element type, 3/8" female pipe thread ports. Capacity, 16 gallons per minute. A $13.00 value. Now **Postpaid**.... **4.95**

(Item #42)

ITEM #4—All steel double action hydraulic cylinder. 1 1/8" bore, 2 7/8" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. **Postpaid**..... **4.95**

ITEM #33c—Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. **Postpaid**..... **8.95**

ITEM #32—Double action, 1 1/2" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value. **Postpaid**..... **10.95**

ITEM #16C—Double acting hydraulic cylinder, 1 1/2" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A $55.00 value. Now only. **Postpaid**.. **16.95**

ITEM #103—Double acting hydraulic cylinder, 2 1/2" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. 1 1/4" diam shaft. 3/8" tubing thread ports. Overall length closed 28". Shpg. wt. 11 lbs. F.O.B. Chicago..... **21.50**

ITEM #31c—Double action hydraulic cylinder, 3 1/2" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1 1/8" piston rod. Clevis mounting at base and shaft. 19 1/2" overall length closed. Will lift 9625 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic Pump. Uses 3/8" tubing fittings. Value $102.00. Shpg. wt. 11 lbs. F.O.B. Chicago **22.50**

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1 1/8" stainless steel shaft. Gov't acq. cost $176.00. Shpg. wt. 26 lbs. F.O.B. Chicago..... 28.00

ITEM #42—Double action hydraulic cylinder. 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An excellent Buy for..... **32.50**

NEW! STATIONARY OR PORTABLE D.C. Arc Welder

250 AMPS. MODEL 252 (ITEM #65)

FOR ANY WELDING JOB LIGHT OR HEAVY

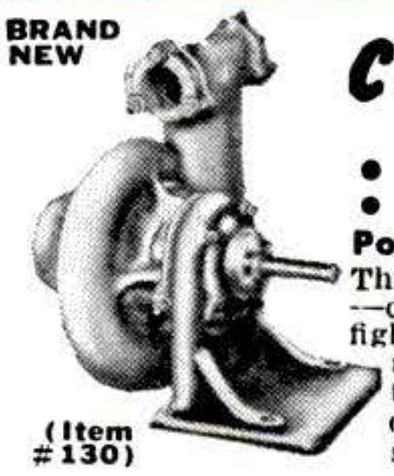
STOP COSTLY REPAIR BILLS, WELD IT YOURSELF AND SAVE

Now at a fraction of its value

Only one or two jobs will pay for entire welder. Designed for many years of trouble-free service. This precision-engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor. a 7 1/2 HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley). Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago **99.50**

GENERAL MOTORS—ALLISON CENTRIFUGAL PUMP

BRAND NEW



(Item #130)

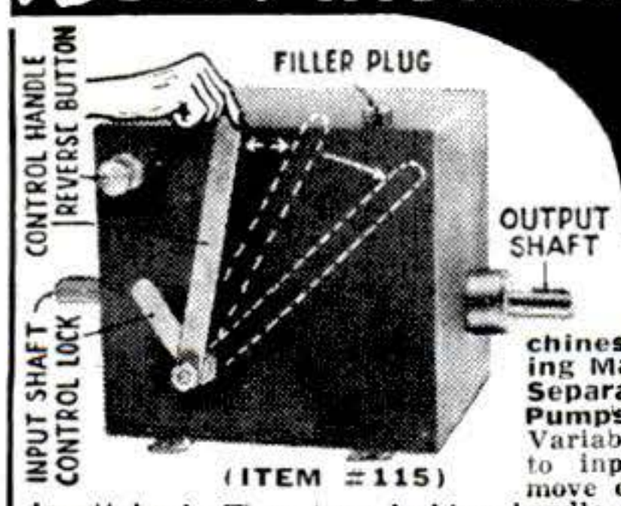
200 GALLONS PER MINUTE

• For Draining Basements • Fire-Fighting • Irrigation • Fuel Transfer • Swimming Pools • Home Water Systems • Dewatering

This General Motors-Allison Centrifugal Pump —designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 2 1/2" standard pipe thread, twin outlets with 1 1/4" pipe thread, ball bearing supported 3/4" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00. Now Only **39.50** F.O.B. Chgo.

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

new! HYDRAULIC SPEED REDUCER WITH FINGERTIP CONTROL



(ITEM #115)

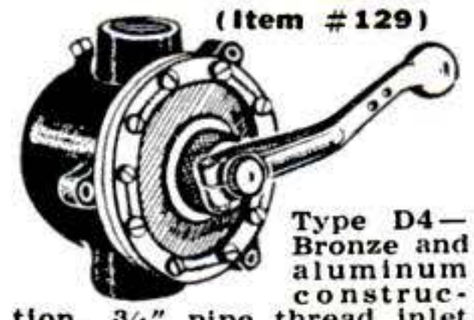
USE FOR: Reamer Drives • Midget Cars • Feed Mills • Canning Machines • Conveyors • Lathes • Milling Machines • Motor Boats • Cream Separators • Garden Tractors • Pumps

Variable output speeds ranging from 0 to input speed now available. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of 1/4 to 1 1/2 H.P.

This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Overall dimensions 7 1/2"x7 1/2"x11 1/2". Gov't. acquisition cost, $428.00. Shipping weight 26 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago..... 54.50

HAND FLUID PUMP

(Item #129)



Type D4—Bronze and aluminum construction, 3/4" pipe thread inlet and outlet. Fine general utility hand pump. May be used as a sump pump, barrel pump, fuel transfer pump, etc. Shipping wt. 7 lbs. F.O.B. Chicago..... **11.95**

LOGAN HEAVY DUTY Hydraulic Pump or Motor

(Item #78)

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 600 RPM at 1000 P.S.I. using 6 HP. Has a 3/8" inlet, 1/2" outlet. 3/4" shaft with flat and keyway for direct or pulley drive. For greater capacity tap out ports to 3/4" for 16 gallons per minute. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5 1/2" H x 5 1/2" W. A 105.00 value FOR ONLY F.O.B. Chicago..... **22.50**

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- **DeLuxe Hand Winch.** Dual ratio 1 to 3, 1 to 9. Finest steel. Powerful. 3,000 lb.....**$30.00.** Same except with 50′ cable & hook.....**$ 39.50**
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- **Snatch Block.** Medium duty, 4″. 3000 lb. working strength....**$ 5.50**

Air Compressors—Paint Spray Units—Tanks—Hose

- **Build Your Own Compressor Outfit.** Finest 1-cyl. piston compressor. pop off valve. stainless 12″ x 25″ air tank, 160-lb. gauge, genuine W.R. Brown paint spray gun, dust blow gun, tire chuck, 15′ hose, fittings, and "How to assemble" manual. Ideal farm unit.....**$ 39.90**
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- **De Luxe Piston Air Compressor.** Leading make. Finest construction. 1.75″ stroke 2″ bore. To 150 lbs. To 3 c.f.m. With pulley.....**$ 20.50**
- **Air Tanks.** Light weight hi-strength type. 400 lb. working. Use on farm, in car, etc. 500 CI....**$4.95,** 1000 CI....**$4.95,** 2100 CI....**$ 9.95**
- **Air Accessories.** Check valves....**$3.75,** Safety valve....**$1.95,** Pressure regulator....**$2.69,** Auto. press. Switch....**$5.89,** heavy duty paint gun....**$8.95,** Pressure gauges....**$1.89,** engine cleaners.....**$ 8.96**
- **Air Hose.** Top quality. Leading makes. Two braid heavy duty with fittings (¼″). 15 ft.....**$2.95,** 20 ft.....**$3.80,** 50 ft.....**$ 8.50**

Write for free air compressor bulletin and catalog.

Water Pumps—Water Systems—Farm Gas Pumps—Weed Spray Units

- **Complete Automatic Pressure Water System.** Leading make. Fine for farms, cabins, etc. 110-volt 60-cy. 300 g.p.h. 22′ lift.....**$ 69.50**
- **Bronze Medium Pressure Rotary Pumps.** Up to 25 lbs. Stainless shaft, Self priming. Lift 10′ without foot valve 22′ with. Efficient. ½″ 6 g.p.m. **$12.95,** ¾″ 10 g.p.m. **$16.95,** 1″ 19 g.p.m. **$22.95**
- **Bronze High Pressure Rotary Pumps.** Up to 150 lbs. Stainless shaft, self priming. Lift 10′ without foot valve 22′ with. Excellent. ½″ 5 g.p.m. **$14.50,** ¾″ 8 g.p.m. **$20.95,** 1″ 17 g.p.m. **$27.95**
- **Centrifugal Irrigation Pumps.** Cast iron-bronze, stainless shaft, 7500 gal. per hr. 2″ suc., 1½″ dis. Ball bearing.....**$ 34.79**
- ● ● ● **All Brass DeLuxe Tractor Weed Spray Outfit.** Popular make at over 40% saving. Consists 4-row brass boom with genuine T-Jet 5 g.p. acre, nozzles, easy mount any tractor, gauges, valves, hose, direct drive tractor pump, relief valve, etc. A guaranteed value.....**$ 84.50**

Write for free pump bulletin and catalog.

A-C Power Plants—A-C Generators—D-C Arc Welders

- **Army 5,000-Watt, 110-220 volt, 60-cy. Plants.** Excellent. Onan generator direct coupled to 4-cyl. water cooled engine. Push-button start, complete instrument panel, etc. Cost over $1200.....**$795.40**
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- **Army 1,400-watt, 110-volt, 400-cy. Plants.** Homelite complete with tools—spare parts. Fine for cabins, emergency lights, etc.....**$129.60**
- **Army 5,000-watt, 110-volt, 60-cy. Generator.** Kato unit, Excellent emergency source. Complete with 4-sheave pulley, voltmeter, voltage control, throw over switch, breaker, etc.....**$269.50**
- **Air Corp. 1,000-watt, 110-volt, 800-cy. Generator.** Made by Bendix. Ball bearing. Fine for lights, heaters, etc.....**$ 18.96**
- **Delco-Remy 200-Amp. D-C Generators.** Voltage 28.5. Excellent for welding generators. Full instructions for construction top quality farm welder. Weigh 50 lbs. Cost Govt. over $250.00.....**$ 19.95**
- ● ● ● **DeLuxe Farm-Business D-C Arc Welder.** Built by a leading Chicago engineering firm using $276.00 war surplus generators. Will furnish up to 250 amperes of voltage stabilized smooth welding current. Complete with driving pulley, instructions, etc. Ready to use.....**$ 99.50**

Miscellaneous Special Equipment Closeout Bargains

- **Rural Magneto Phones.** Wall type. Oak case. Modern. 5-bar..**$ 12.40**
- **Factory-Contractors Phones.** Magneto wall oak. 3-bar.....**$ 10.25**
- **Private Phones. City Type.** Desk handset type. Def. cases...**$ 18.25**
- **Private 2 Station Desk Phone Sys.** Comp. with buzzers. Pair **$ 9.77**
- **Telechron Clock Time Switch 110-V.** Turn radio, stove on, etc **$ 4.98**
- **Gas and Electric Chain Saws.** Send for bargain listings on these.
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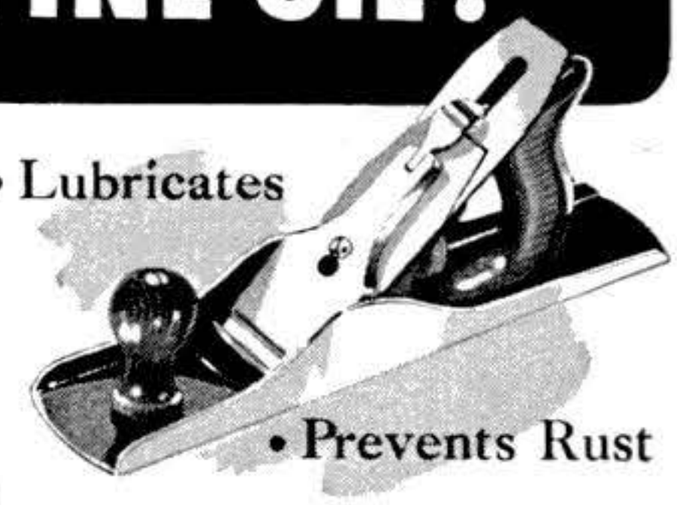

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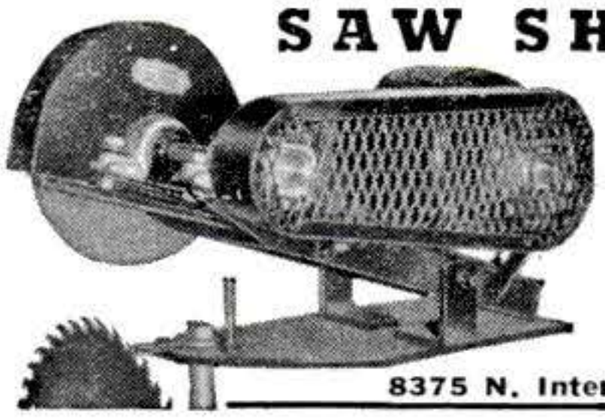

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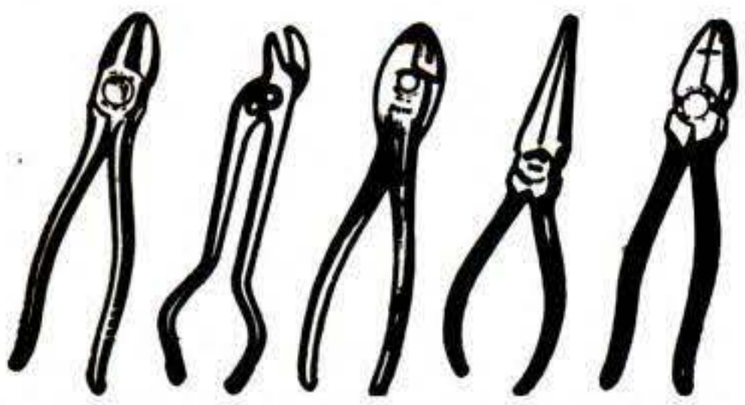

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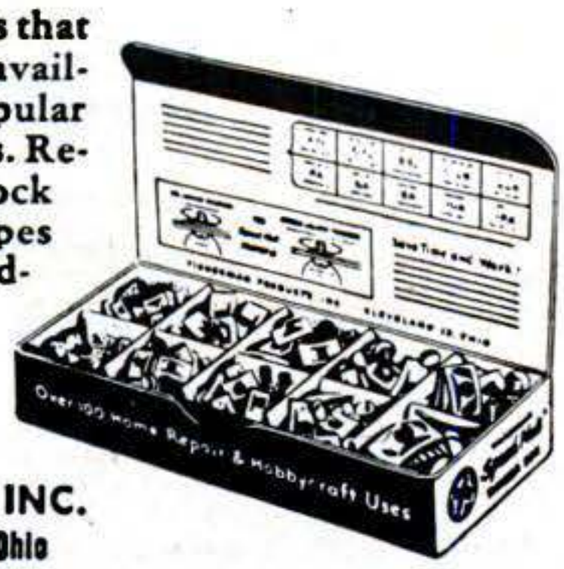

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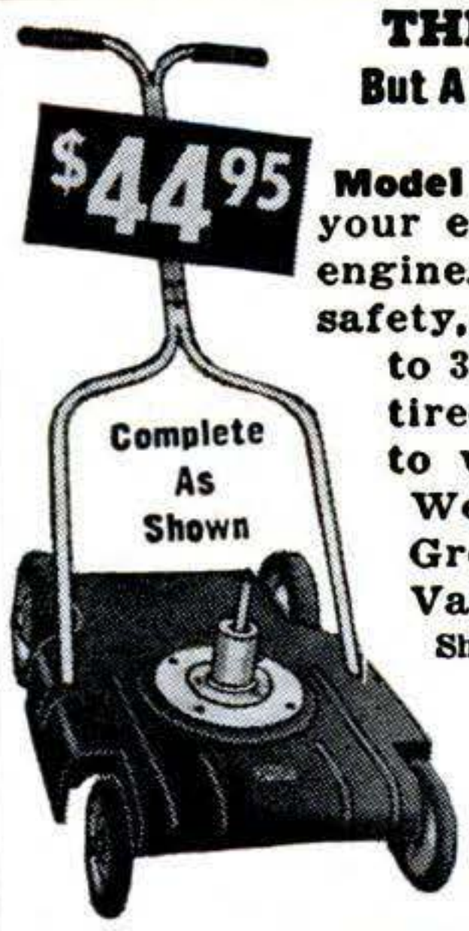

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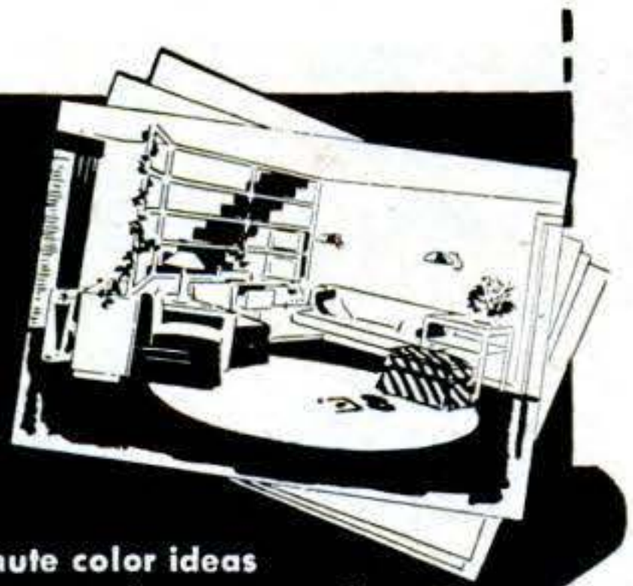

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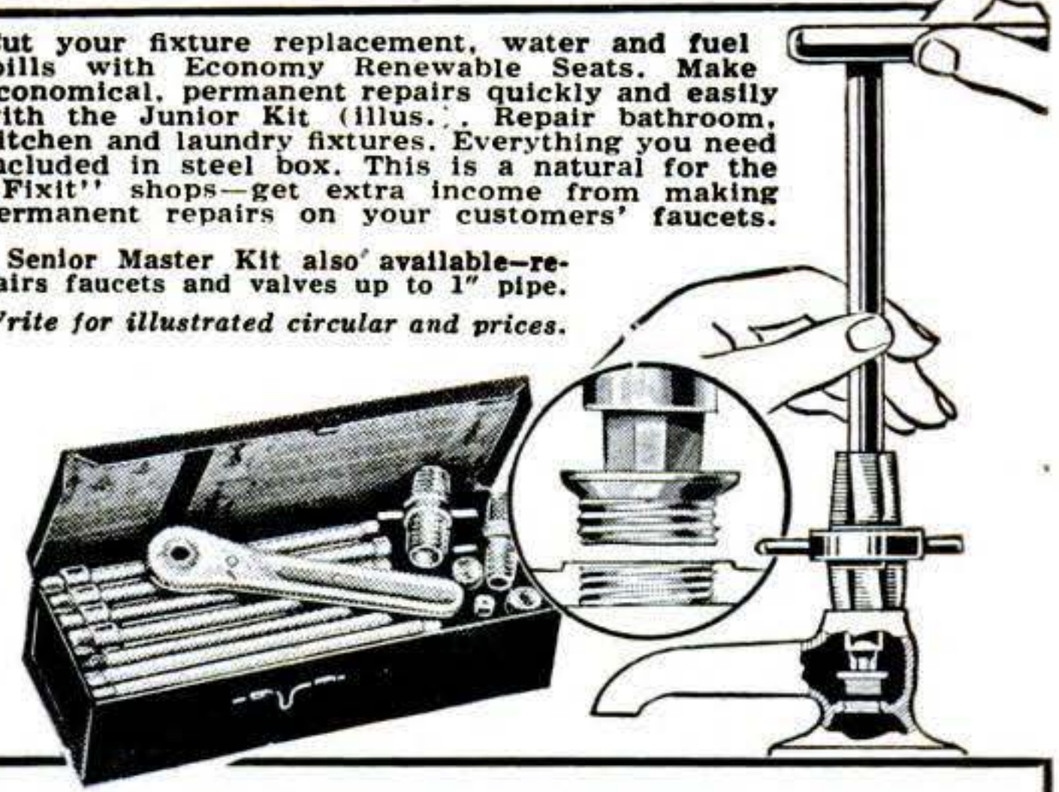

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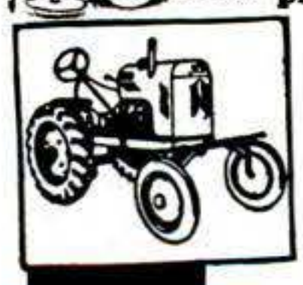

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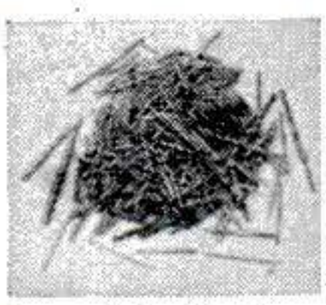

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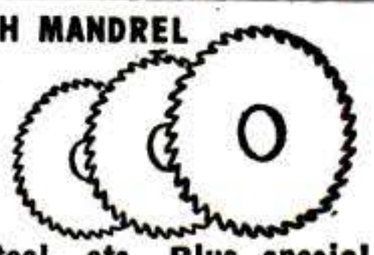

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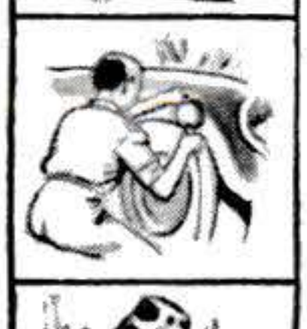

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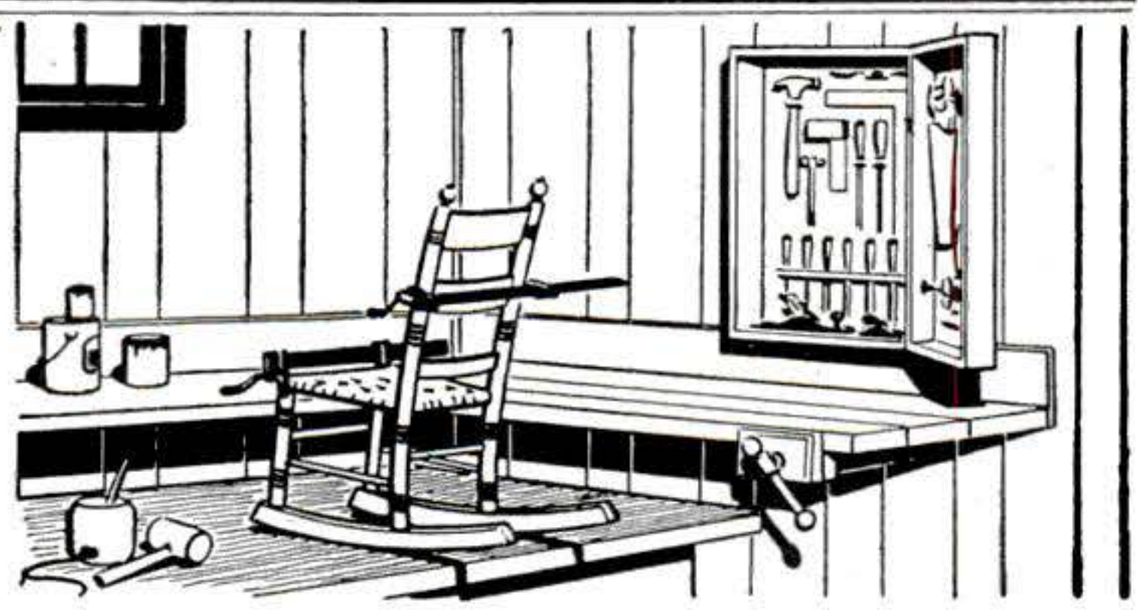

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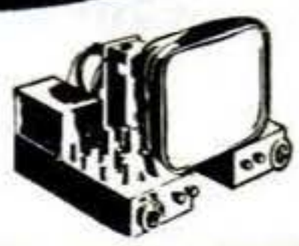

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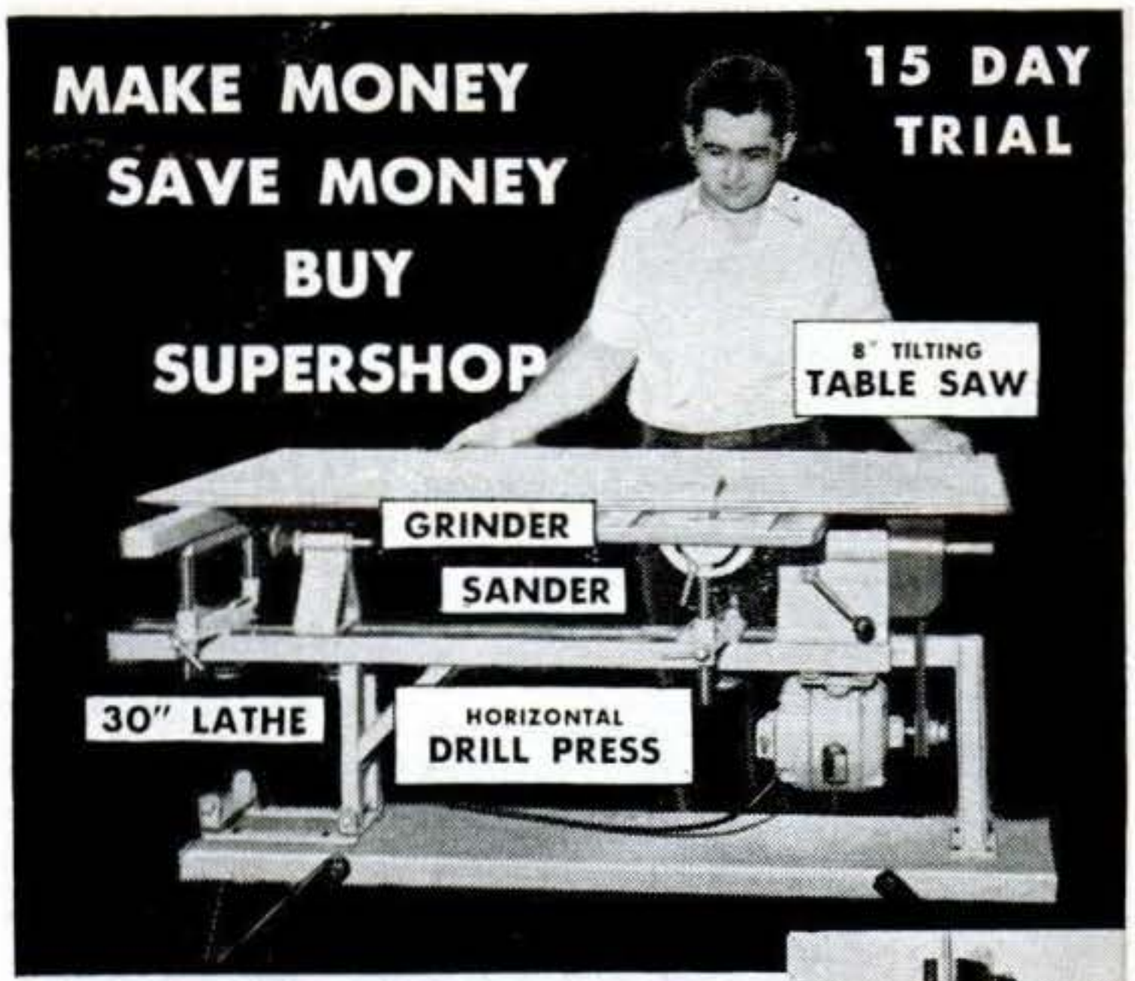

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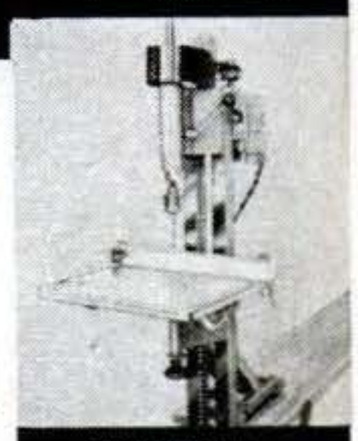

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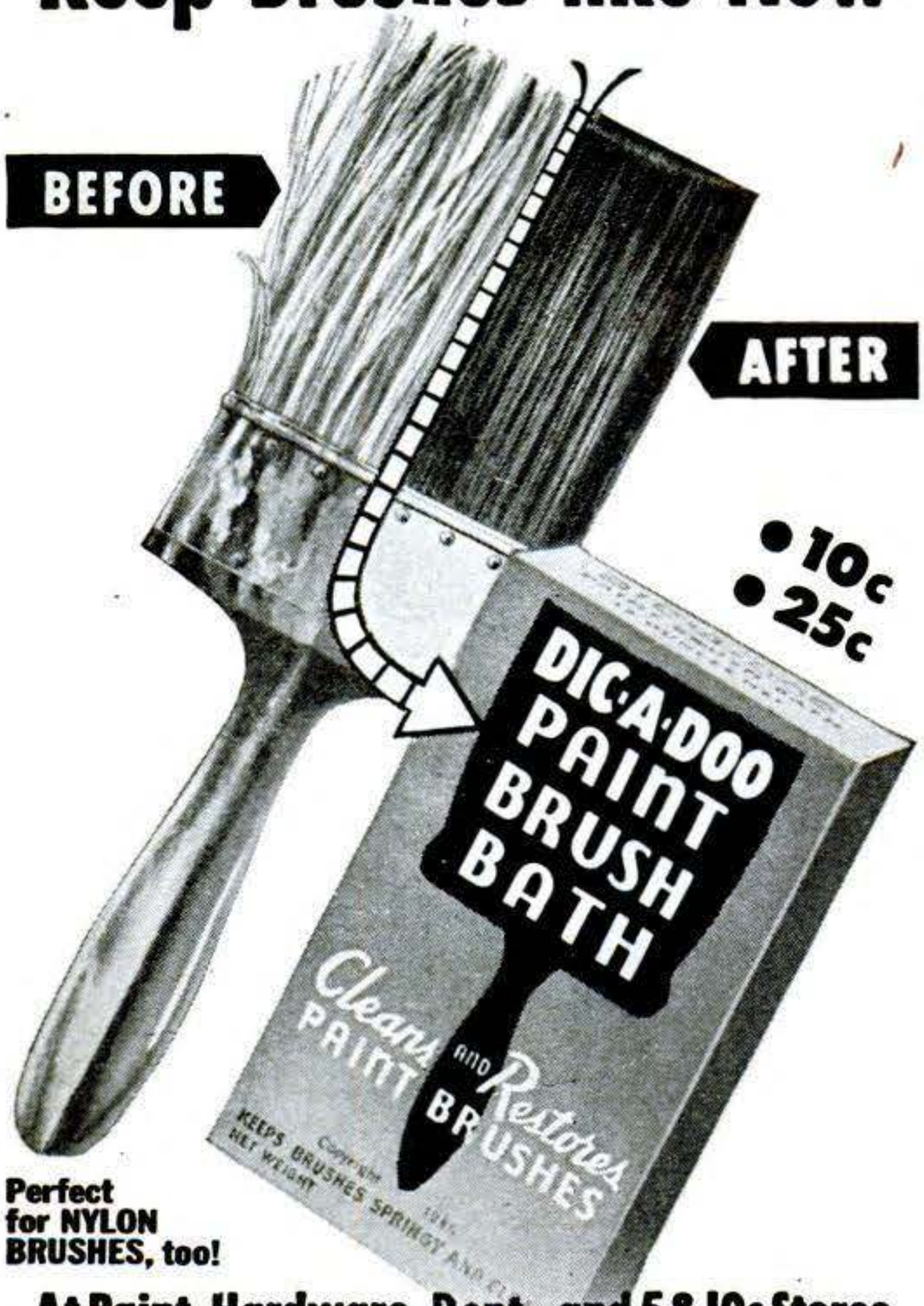

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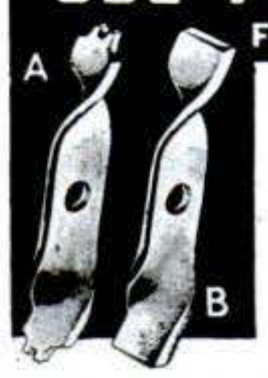

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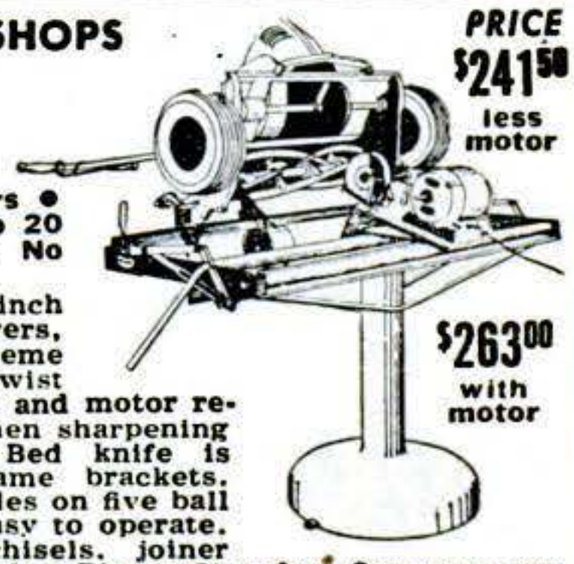

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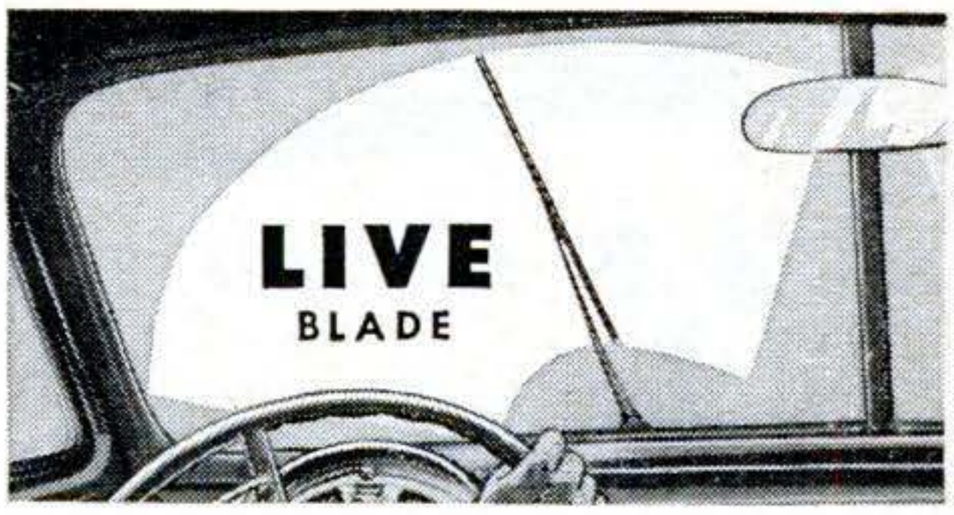

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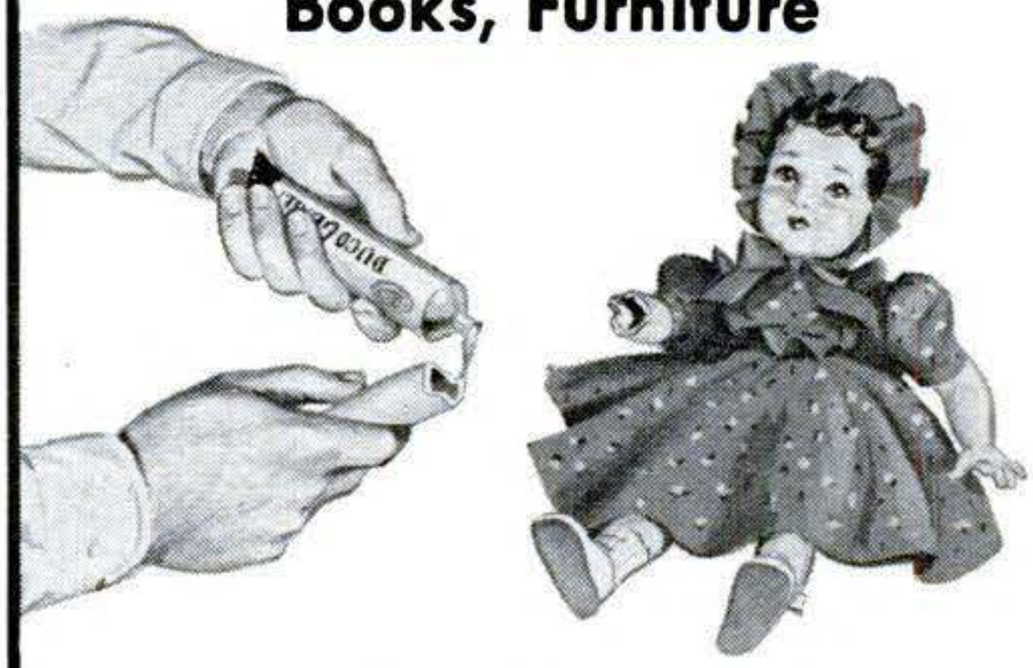

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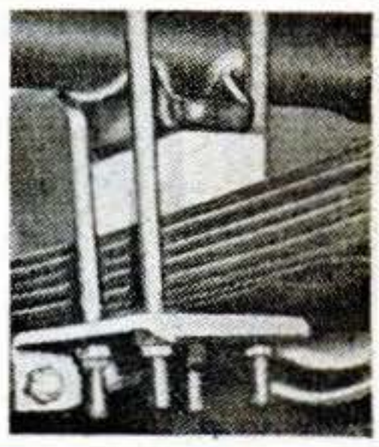

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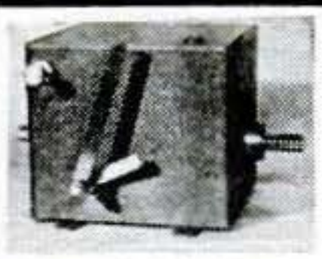

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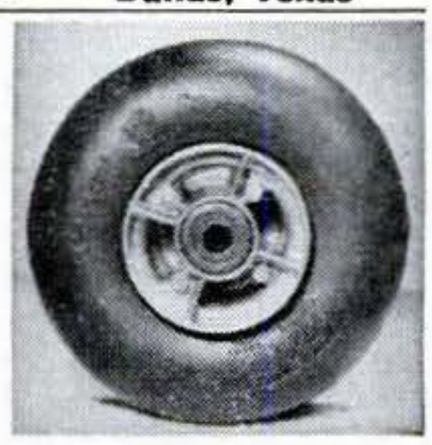

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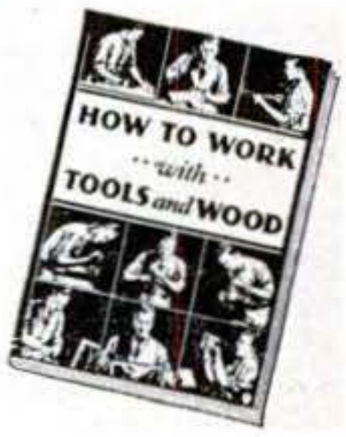

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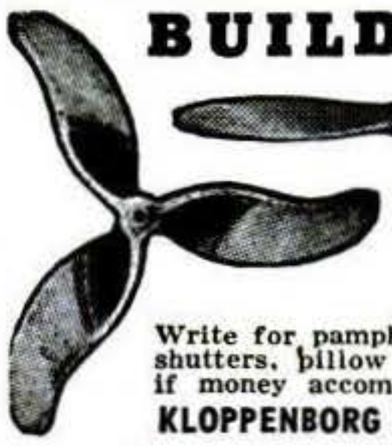

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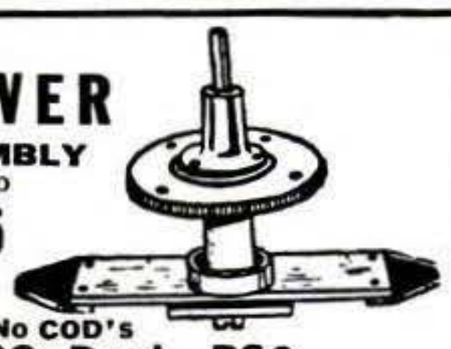

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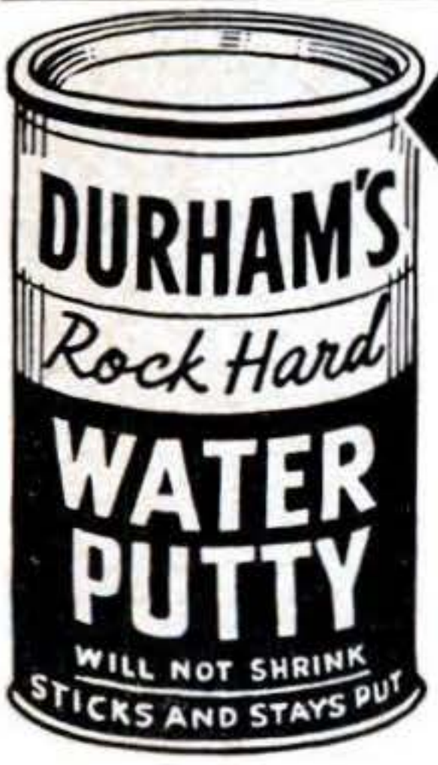

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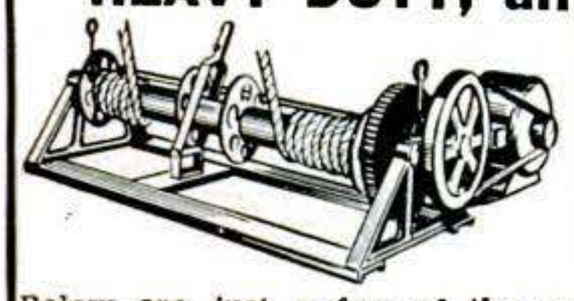

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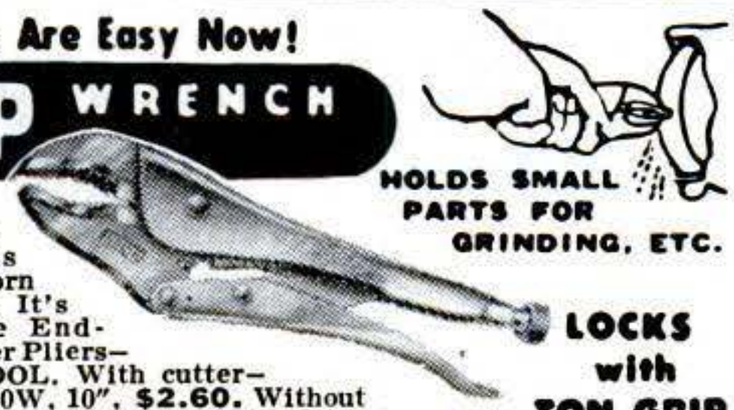

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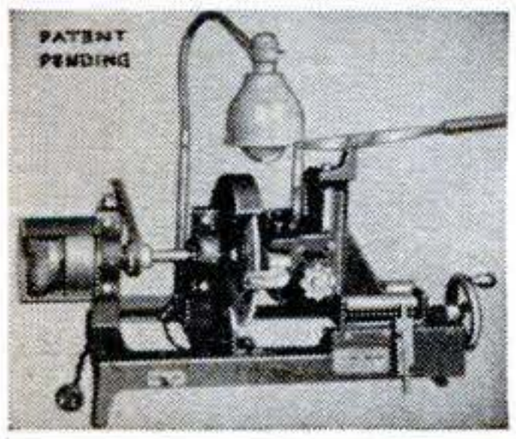

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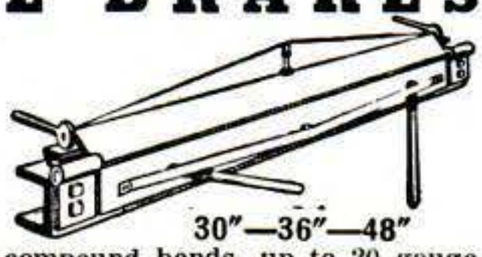

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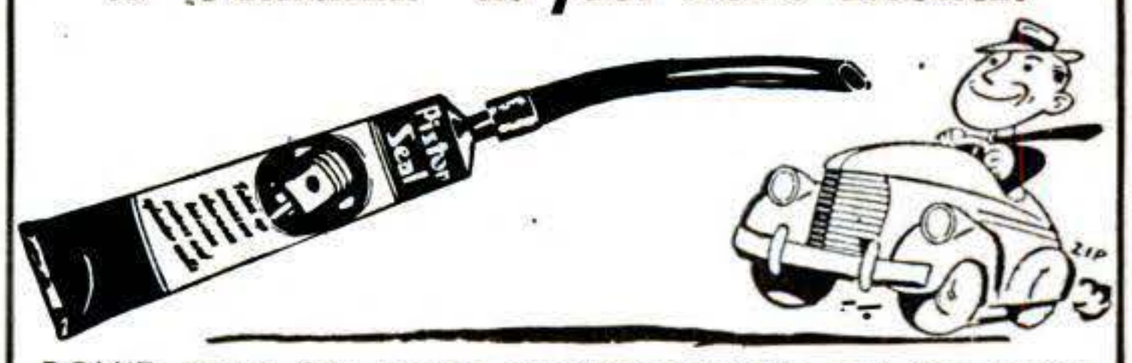

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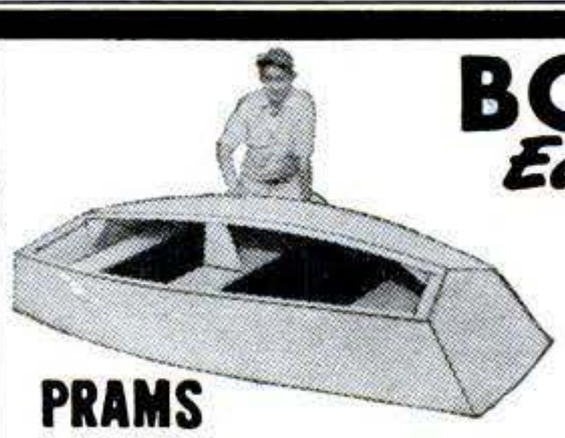

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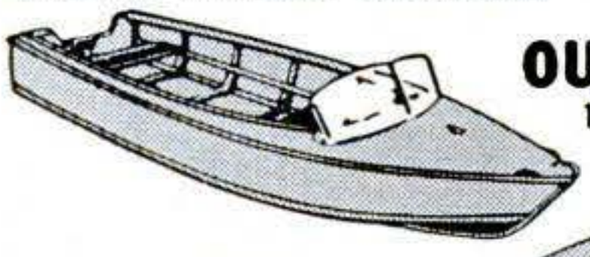

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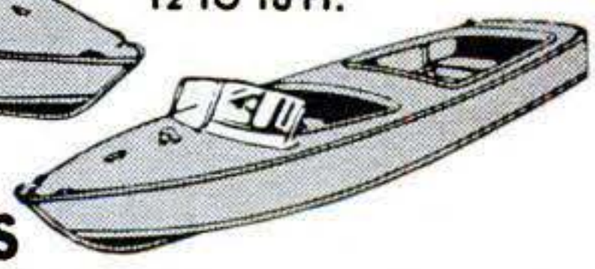

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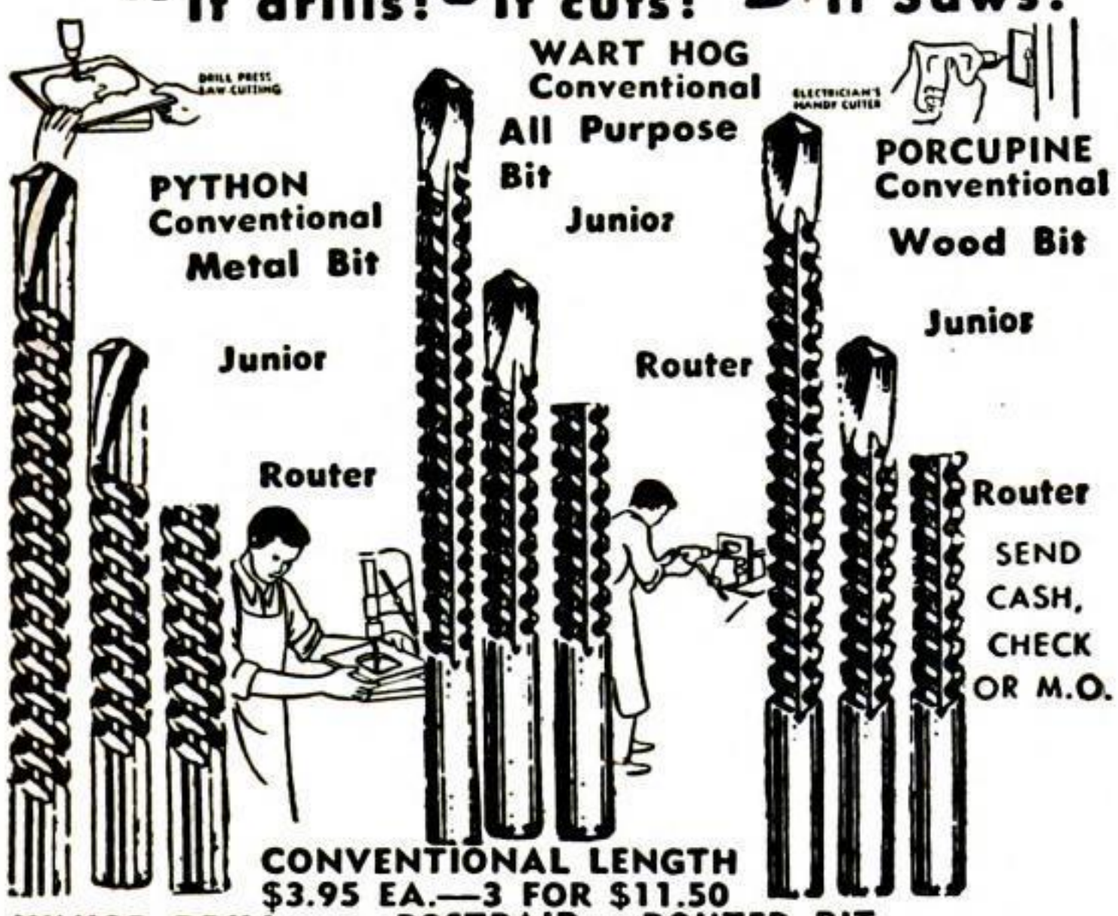

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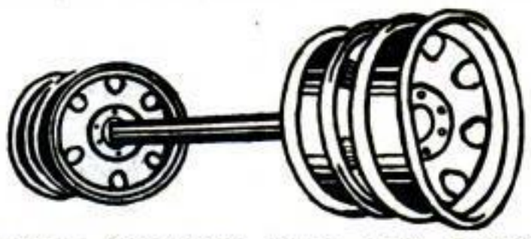

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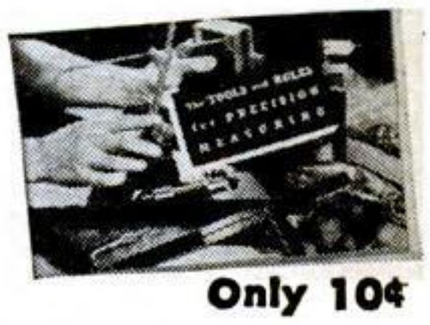

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Compressor has 2" bore, 1¾" stroke, 2.8 cfm up to 150 lb. pressure. Motor required: ¼ h.p. at 100 lbs.; ⅓ h.p. at 125 lbs.; ½ h.p. at 150 lbs. or equivalent gas engine. V-belt drive, intake muffler and cleaner, bronze bearings, splash lubrication. Wt. 16 lbs. Replacement parts always available..... **$20.50**

COMPLETE OUTFIT. Compressor, pressure tank, air gauge, air chuck, 20 ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. COMPLETE OUTFIT, wt. 30 lbs. **$32.45**

Equipment less compressor **$12.45**

All Brand New Equipment

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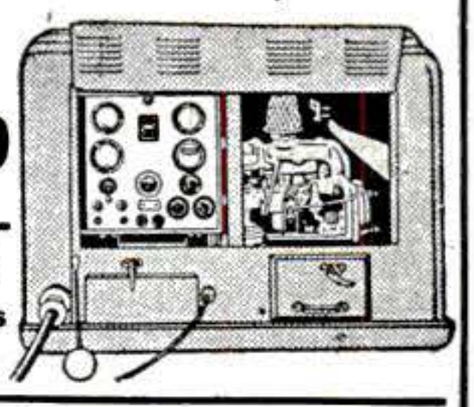
5 KW
$2200 Value
$895.00



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500 and 2000 Watts
BARGAINS!
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Wisconsin GAS ENGINES

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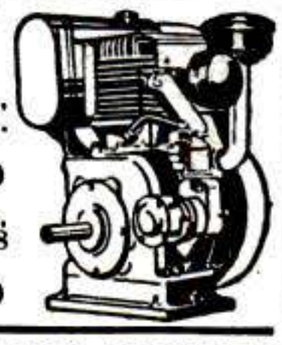

BRAND NEW
Model A.B., 2.5 to 3.4 H.P., 2½" bore, 2¾" stroke, 13.5 cu. in. Wt. 60 lbs.
List Price, $90.00. Special Price..... **$76.00**
Model A.K., 3.5 to 4.7 H.P., 2⅞" bore, 2¾" stroke, 17.8 cu. in. Wt. 70 lbs.
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¼" Air Regulator. Gauge and filter. Wt. 5 lbs.
BRAND NEW!
$8.95
Regulator and Gauge only..... **$5.95**
Air Filter only..... **$3.25**

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BRAND NEW. 1½ HP with 6 to 1 reduction gear. Operates at 450 R.P.M. For lawn mowers, scooters, garden tractors, pumps, compressors, generators, etc. List Price $79.50. Shipping weight 54 lbs.
SPECIAL PRICE..... **$47.50**
Same engine furnished at 2600 RPM. **$46.50**

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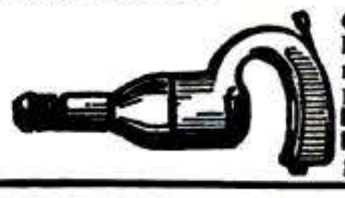
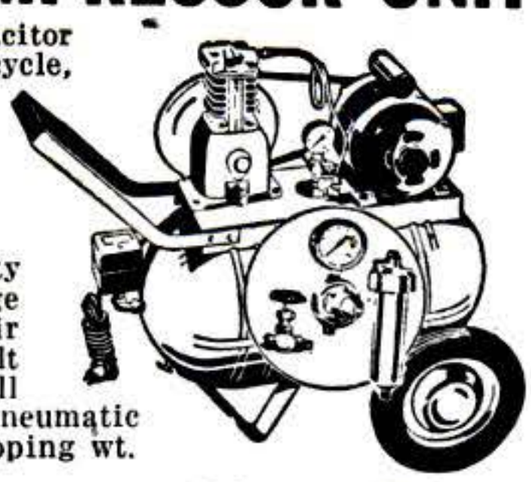


CP4X or CP3X Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price $73.00
Brand New..... **$32.50**
Like new, guar..... **$17.50**

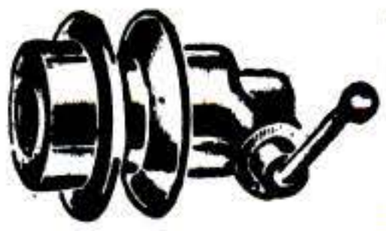
AUTOMATIC COMPRESSOR UNIT



⅓ or ½ H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle, 2x1¾ inch piston type compressor, splash feed lubrication. 12x24 inch tank, automatic pressure switch. CFM 2.8 at 100 lbs. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, 20 ft. air hose with air chuck for inflating tires. V. belt drive. Mounted on 2 wheels, ball bearing, with 2"x10" semi-pneumatic tires. Portable with handle. Shipping wt. 90 lbs.

with ⅓ h.p. motor $160 value..... **$98.50**
unit less motor..... **$79.50**
with ½ h.p. motor..... **$109.50**
furnished with 1½ h.p. gas engine..... **$124.50**

WELLWORTH V-BELT CLUTCH



Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **$7.50**
BUSHING FOR ½" SHAFT, 15c

BRAND NEW! SAME CLUTCH FURNISHED WITH ¾" BORE $8.50

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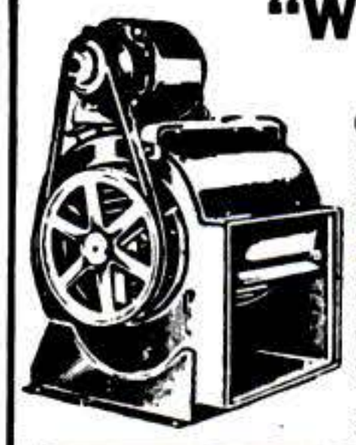
BRAND NEW



Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛" x 11⅜"; inlet 8¾". Height 19". Width 18". Depth 16½"; C.F.M., ¼" S.P. 1600; outlet vel. 1575; wt. 45 lbs.
BLOWER LESS MOTOR AND DRIVE..... **$27.50**
With 8" pulley for blower—3½" variable speed, pulley for motor, and belt **$2.50** extra.

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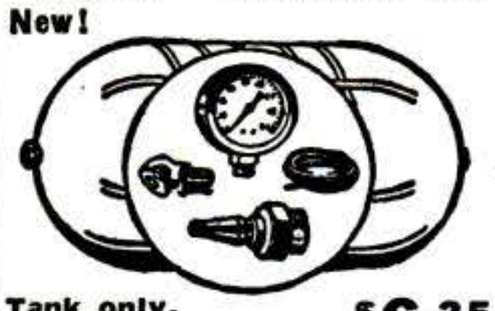
New!



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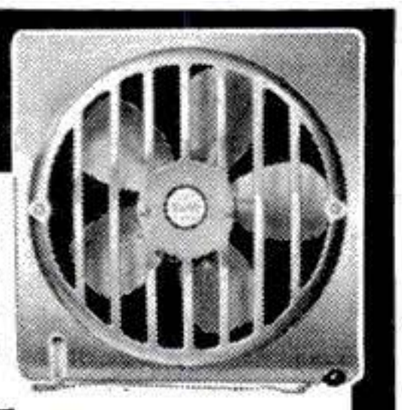

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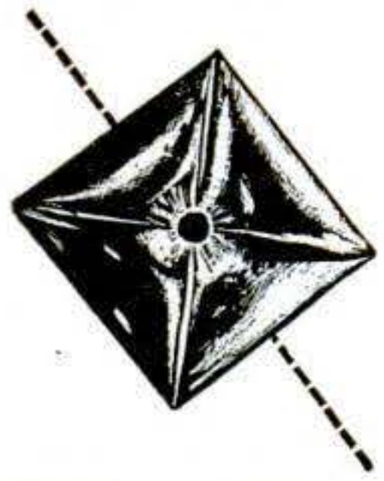

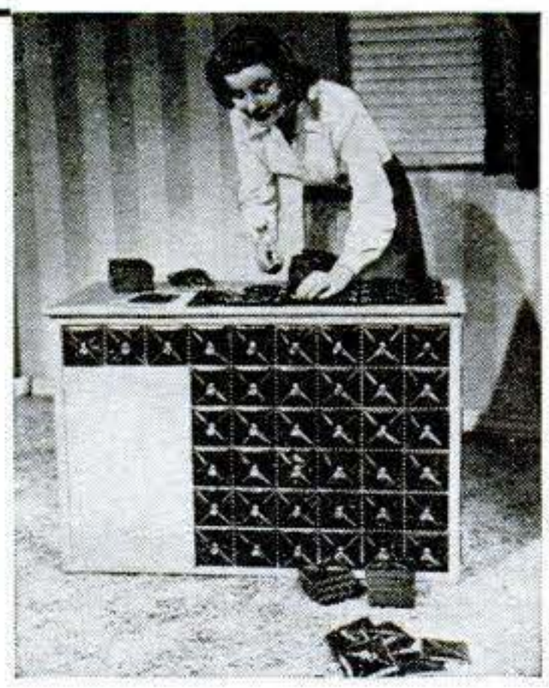

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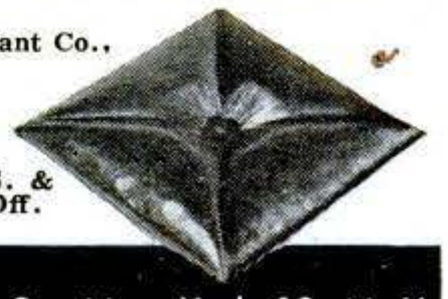

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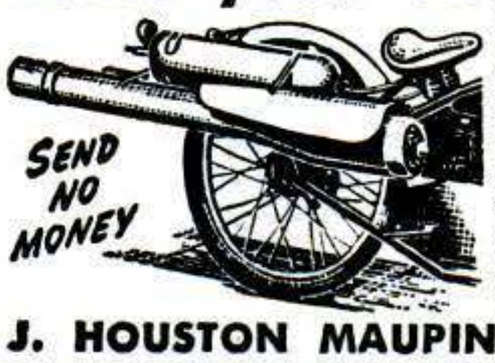

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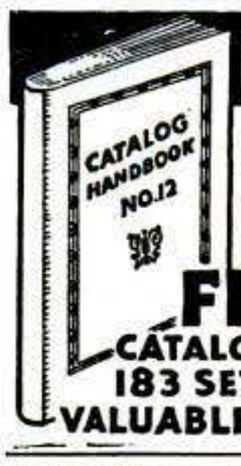

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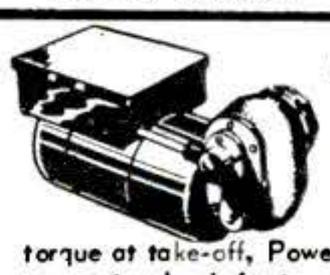

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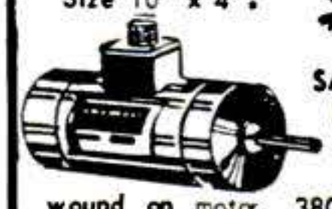

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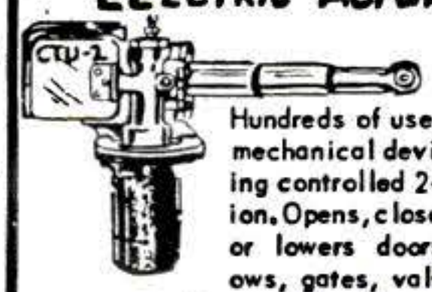

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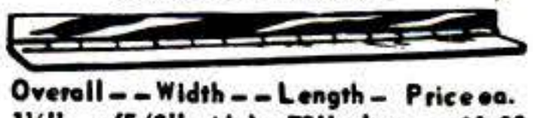
30-A 60-A 120-A 150-A 240-A 300-A **1.25**

PIANO HINGE



Overall – Width	– Length	– Price ea.
1¼" - (5/8" side)	- 72" alum.	- $1.00
2" - (1" side)	- 9'" alum.	- $1.75
3½" - (1¼")	- 54" st. steel	- $1.69

BRASS HINGE - 1¼" (5/8" side - .040 thick) Any length at . . . per ft. .29

PALLEY FAMOUS MIXES!! Prepared especially for the HOME CRAFTSMAN, HOBBYIST, INVENTOR, GADGETEER or SHOP MECHANIC.

GADGET MIX – Rivets, Spacers, Bolts, Screws, Gears, Wheel bearings, Springs and Clamps. No. 106, 5 lbs. . . . **1.19**

BEARING MIX. No. 170A. Approx. 20 needle, Ball & Roller Bearings, New & Used. Sizes 1/2" to 4". Some of these cost Gov't $10 a piece. Never such a value! 5 lbs. ONLY . . **1.59**

HINGE MIX, No. 170H. 12 pairs of Strap and butt hinges, Hasps, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. **1.09**

ABRASIVE AND GRINDING WHEEL MIX – 50 pieces including honing stone, pencil rolls, wheels, etc. A sharp value. No. 170AG **99c**

SPRING MIX, No. 206 – Torsion, Compression & Tension Springs. Asstd. sizes. A treasure trove for emergencies. Scores of springs. 5 lbs. for ONLY. . . **1.69**

RIVET MIX – 3 POUNDS – Consisting of sizes from 1/4" to 3" long in many diameters & alloys. **1.19**

FILE MIX – Ten assorted Files – 4" to 12". Includes Vixens, half rounds, mills, bastards, etc. – in seconds and used but good condition. 1 Vixen alone is worth our price for entire mix. . . **99¢**

PULLEY MIX – You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made – with hundreds of uses. A WONDERFUL BUY! **2.95**

SCREW MIX – 5 lbs., Including assortment of wood and machine screws. Many sizes. Save dollars and alway have plenty of screws on hand. . **1.39**

NUT MIX NM-1 – 3 lbs. approx. 500 nut. Anchor, Lock, Castle, Hex, Elastic Stop Nuts, etc. You'll always have plenty of Nuts in the shop. NM-1 **1.39**

SUPER COMBO MIX – No. SC2. Here's a real bargain. All ten above mixes for ONLY **12.95**

AIRCRAFT CABLE

Rust resistant, alloyed steel. Extra flexible. Pre-formed, 7 x 19 strand. On reels.

1/16" – 4½¢ ft.	5/32" – 7½¢ ft.
5/64" – 5¢ ft.	1/4" – 12½¢ ft.
3/32" – 5½¢ ft.	9/32" – 15¢ ft.
1/8" – 7¢ ft.	5/16" – 16½¢ ft.
7/32" – 10½¢ ft.	3/8" – 18¢ ft.
	1/2" – 20¢ ft.

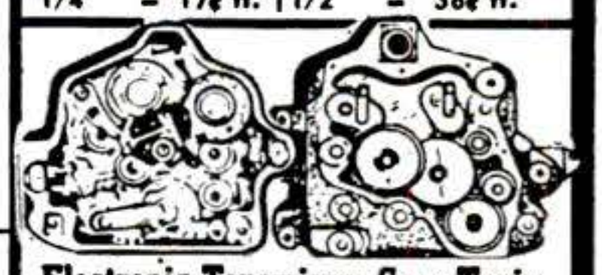
Special! 3/16" cable, 18 ft. long with turnbuckle ends . . . . . .99¢

Stainless Steel Cable – Pre-formed

1/16" – 6¢ ft.	5/32" – 20¢ ft.
3/32" – 14¢ ft.	1/4" – 26¢ ft.

Bronze Cable – Not Pre-formed

1/16" – 5¢ ft.	3/16" – 23¢ ft.
1/4" – 17¢ ft.	1/2" – 38¢ ft.



Electronic Transmissn. Gear Train

GT-1 – approx. 50 Bronze Spur & Pinion Gears, 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets, 40 N.D. ball bearings ½" to 1½" dia., watch springs, bushings, posts, face plates, housings, micro switches 2 miniature controlled clutches, etc. . . Gears in multiple size and sequence identical teeth ratio, giving 100's of gear reduction combinations. Wt. 19 lbs. **8.49**

Order from this ad. All sales final. Prices F.O.B., Glendale. Pay by M.O. or check. P.O.'s accepted from D&B firms. ½ deposit with C.O.D.'s.

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Refinish YOUR OWN HARDWOOD FLOORS *the famous "Bruce Way"*

Everything you need, only $4.35

This is the famous floor finishing kit developed for *professional* use by the world's largest makers of hardwood floors. Contains everything you need to give your own floors a brand new, longer-lasting finish at a big saving. Makes them far easier to keep clean and beautiful because Bruce Finish penetrates "deep-in-the-wood." **Can't be scratched, chipped, or worn off the surface. More than 500,000,000 sq. ft. of floors now finished the Bruce Way.**

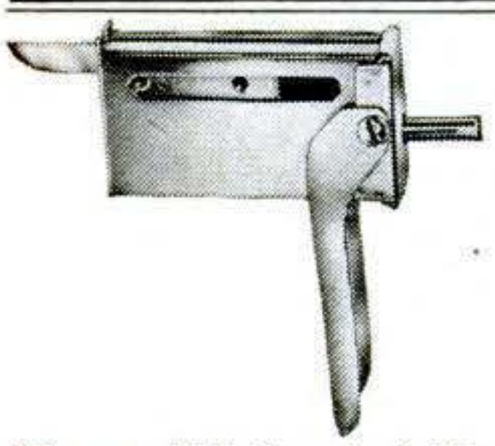
How to do it—After the floor is sanded, just follow simple, easy-to-understand instructions contained in kit. No tools or brushes. No extras to buy. A perfect job every time—without mess or waste.

Where and how to buy—Bruce Floor Finish Kits are available in two shades: Clear (for light floors) and Medium. Also in two sizes: *Small*, for areas up to 250 sq. feet, and *Large*, up to 1000 sq. feet. Each kit contains adequate quantities of filler, finish, solvent, wax, plus cotton waste for application and burlap for cutting off excess filler.

Kits are now available at lumber yards, hardware, paint and department stores, or you may order direct. Be sure to specify shade desired. No C.O.D.'s—check or money order only. All shipments prepaid.

SMALL KIT—$4.35 LARGE KIT—$13.45

E. L. BRUCE CO.
Dept. 600 • Memphis 1, Tennessee



POWERFUL! PORTABLE! POCKET-SIZE!

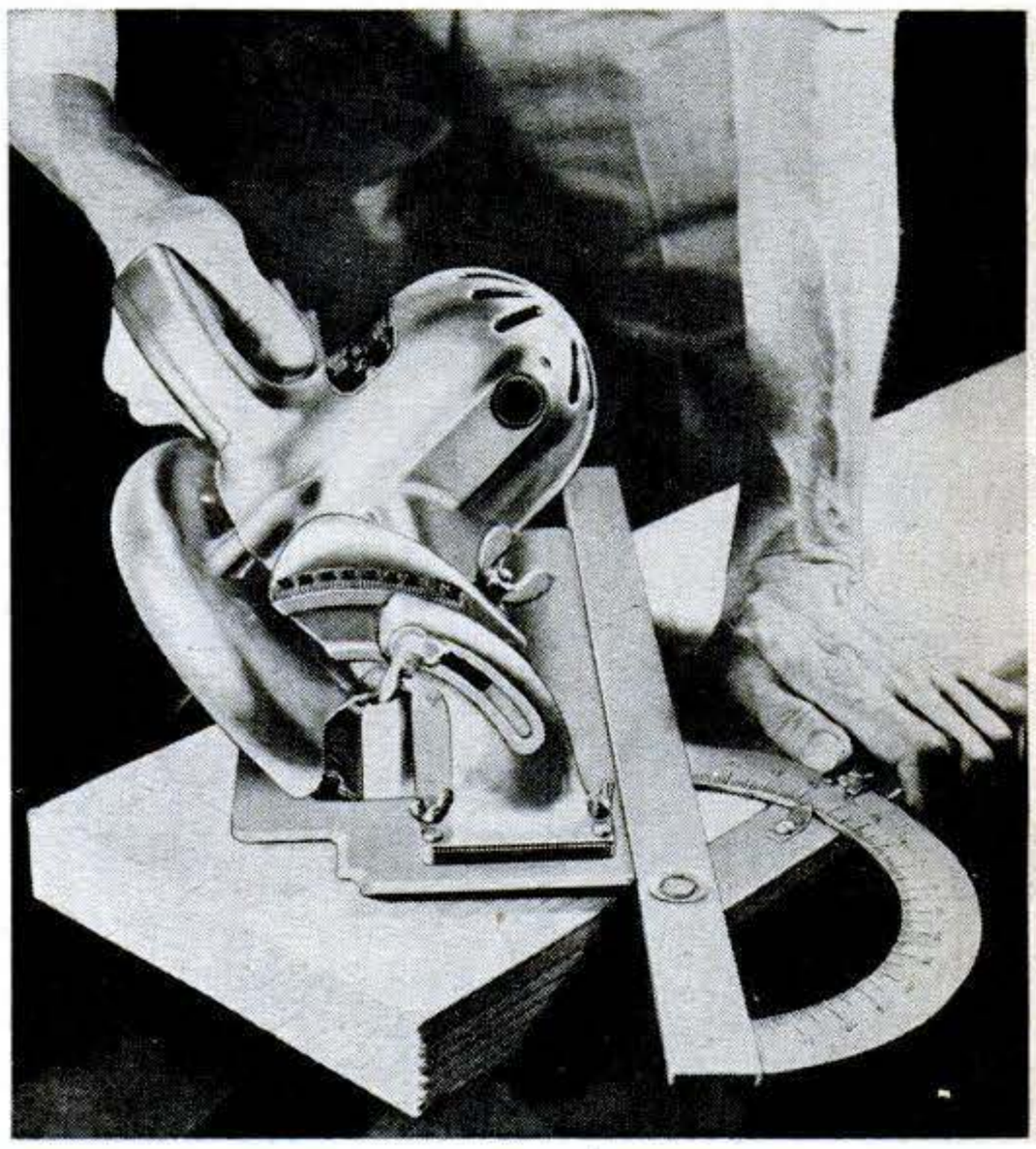
BULL HACKSAW

only $4.95

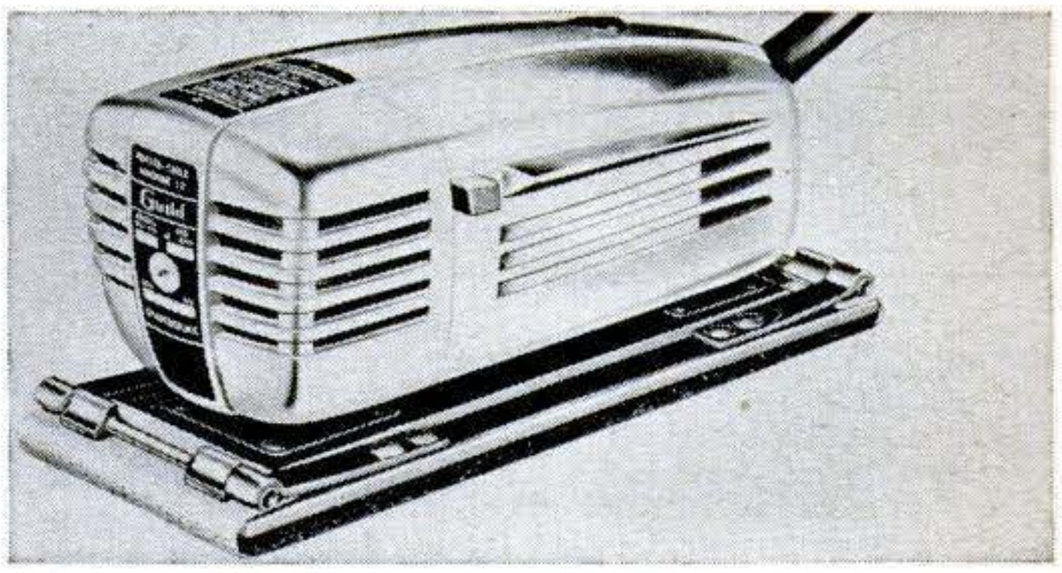
Fits any ¼" electric drill or drill press. Weighs only 11 ozs.; small in size—easy to carry, easy to use. 2-to-1 ratio of drill speed to saw speed for extra power! No gears, no bearings, nothing to wear out. Full chip clearance on any wood, metal or plastic stock up to ¾". Powerful, portable, pocket-size—a must for every home craftsman, only $4.95.
LIFETIME GUARANTEE: At any time, we guarantee to put this tool in perfect working order for a handling charge of 75c.

BERTRUM K. ENGINEERING & SUPPLY CO.
3121 Main Street **Kansas City, Mo.**

New



Protractor for Portable Saws. It's easy to cut angles accurately—particularly compound miters—when using this protractor in combination with a portable saw. The tool is set by loosening a wing nut on the underside and moving the arm until the indicator points to the desired angle. In use, the shoe of the saw is guided by the straightedge of the protractor. The Black & Decker Mfg. Co., of Towson, Md., is the maker.



Finishing Sander. The abrasive pad of this sander moves in a 3/16"-diameter orbit at 5,000 r.p.m. The abrasive grits travel in tiny, overlapping circles to produce a smooth finish. Because of this action, the sander is especially good on joints where cross-grain sanding is necessary. The Porter-Cable Machine Co., Syracuse, N. Y., makes it.

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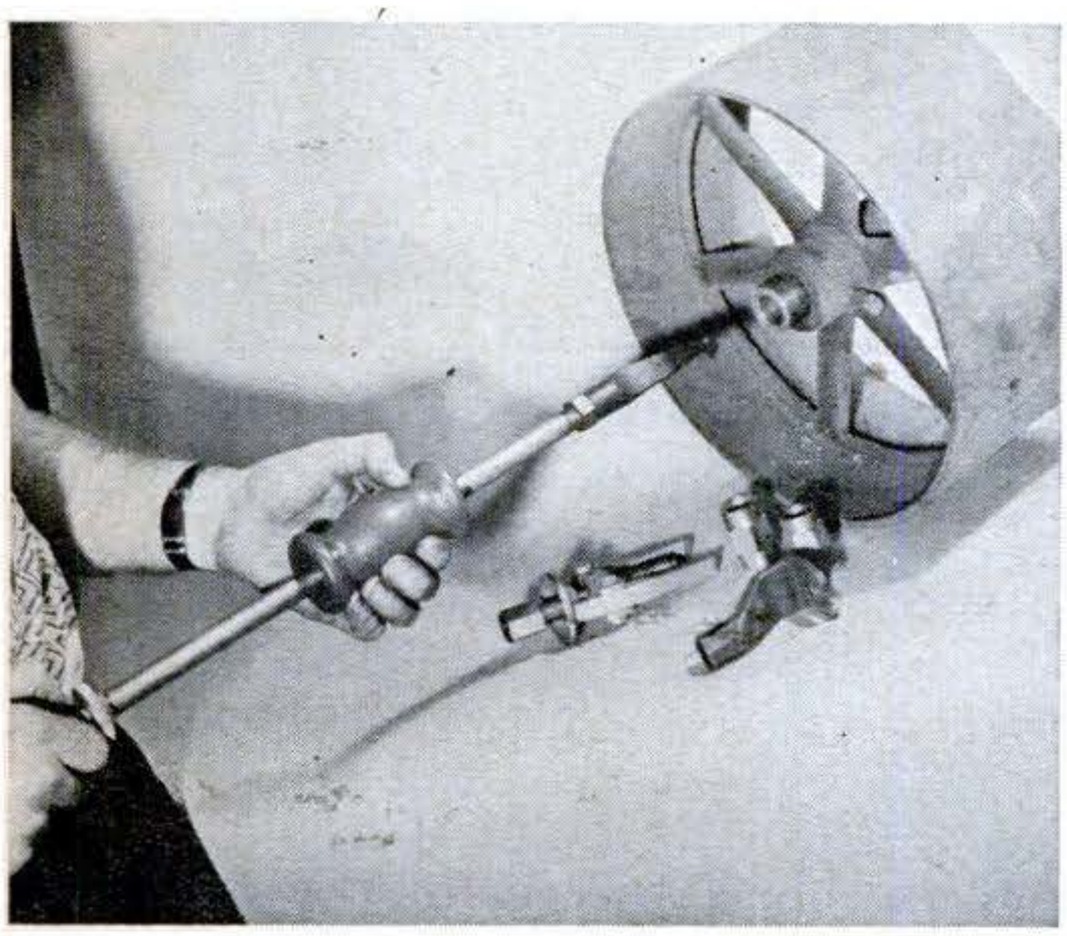
Tools

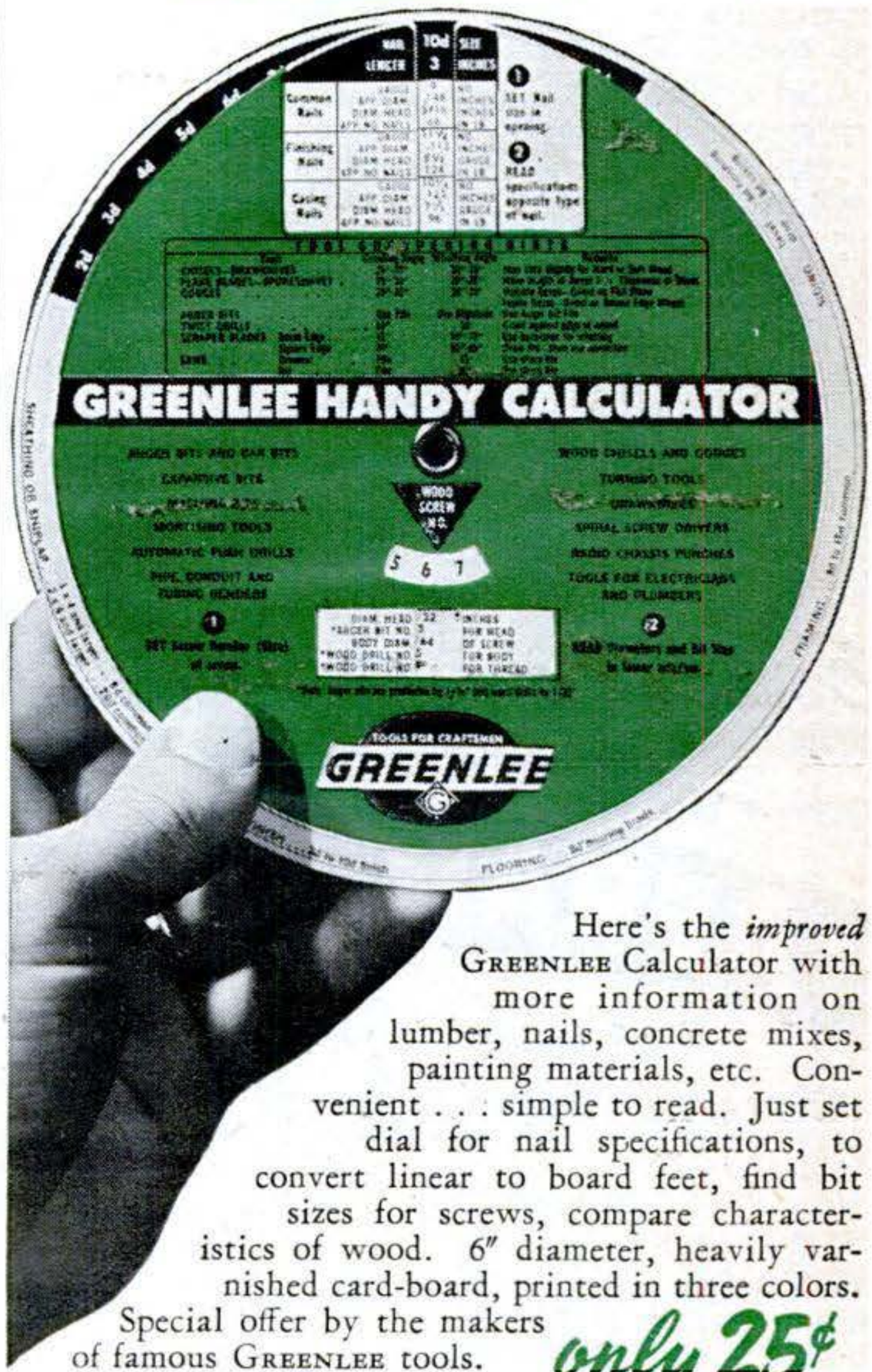


Slide Hammer. This tool is useful in pulling gears, bushings, axles, bearings, and sticking valves. In use, the jaw is clamped, threaded, or hooked on the work and the handle is yanked back sharply against the hand guard. The distributor is Rinck-McIlwaine, Inc., of New York City, and the tool lists for around $4.50.

Magnets Hold Screws in Sockets. An Alnico magnet imbedded in each socket holds self-tapping screws so they can be started, especially in hard-to-reach spots. The sockets also can be used on nuts and bolts. Standard handles and extensions can be used with the sockets. The maker is Snap-on Tools Corp., of Kenosha, Wis.

New improved woodworking calculator

answers countless questions in seconds . . . speeds jobs!



Here's the *improved* GREENLEE Calculator with more information on lumber, nails, concrete mixes, painting materials, etc. Convenient . . . simple to read. Just set dial for nail specifications, to convert linear to board feet, find bit sizes for screws, compare characteristics of wood. 6″ diameter, heavily varnished card-board, printed in three colors. Special offer by the makers of famous GREENLEE tools.

only 25¢

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TOOLS FOR CRAFTSMEN
GREENLEE

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☐ Enclosed is 25c. Send your "Handy Calculator" by return mail.

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best white tape made

ONLY 98¢*

The new "Evans White-Tape" has everything you'll find in tapes costing over $1.50—plus.

- snow-white blade with bold, legible, jet-black numerals and graduations. Graduated in 32nds for first 6 inches.
- sturdy die-cast case heavily chrome-plated, calibrated for quick reading inside and outside measurements.
- blade ½" wide made of finest high carbon steel—tempered—Bonderized—enamelled—baked.
- blade replaceable in seconds—without tools—without even opening case. And Evans replacement blades cost far less.
- every "Evans White-Tape" is unconditionally guaranteed.
- exclusive Evans automatic brake gives smoother push-pull action with absolutely no "creeping" of tape into case.
- underside is white, too. Mark with ordinary pencil, remove mark with flick of thumb.
- unheard-of low price*: 10-ft. $1.49; 8-ft. $1.19; 6-ft. 98¢. Prices higher in far west and Canada.

Sold only through retailers.

Evans & CO. • Newark 5, N. J. ® 7429

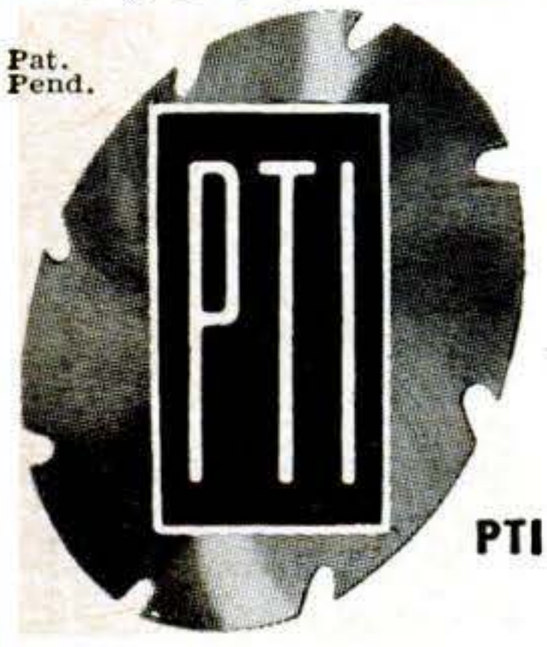
Makers of Evans 6-ft. Folding Rule and "Folding Yardstick"

Don't be AFRAID of your Circular Saw

New PTI SAW BLADE STOPS all Kick-Backs

When you use this remarkable new safety saw blade in your circular saw—you know *positively* that dangerous kick-backs are *completely eliminated!* Direct injuries are minimized, too. The PTI Safety Saw Blade operates on a radically new cutting principle. It cuts easier, lasts longer, uses 30% to 40% less power, is much quieter and cleaner, producing chips, not sawdust.

Pat. Pend.

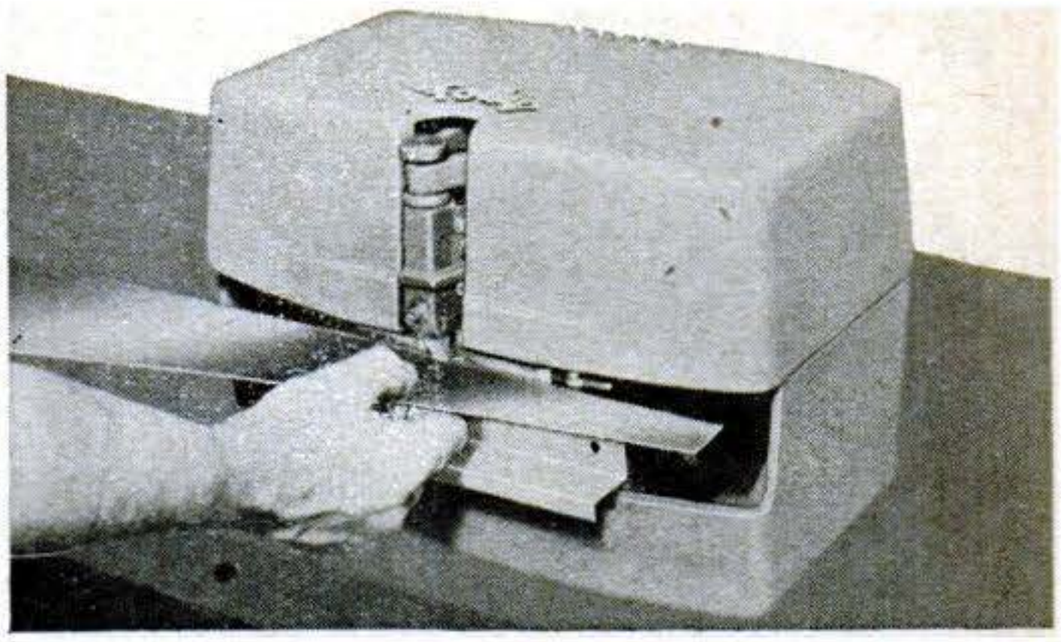


PTI IS THE *ORIGINAL* SAFETY SAW BLADE

tested and approved by leading laboratories, government agencies, industrial concerns. Made of tough Chrome Vanadium Steel—in sizes from 7" to 16". Costs no more than ordinary saw blades. Send *today* for FREE circular giving complete story, specifications and prices. Dept. PS-6

PTI INCORPORATED, 401 Broadway NEW YORK, N. Y.

New Tools



One Pass Sets Both Sides of Saw. Twin hammers—striking in opposite directions—set all the teeth of a hand or bandsaw in one pass through this electric setter. The maker, J. Foley Mfg. Co., Minneapolis, says a 26", 8-point handsaw can be set in 32 seconds and a 3- to 8-point bandsaw in 4 to 15 seconds a foot.

Portable Saw Combines with Table. You can use this unit as a portable saw or as a table saw. The 8¾-lb. saw has a 7" blade with a cutting capacity of 2⅜". It will cut 45° bevels in 2" stock. The table includes an 18" by 22" top, blade guard, miter gauge, and a rip fence. The saw is priced at about $50 and the table at about $30. The maker is the Mall Tool Company, of Chicago.

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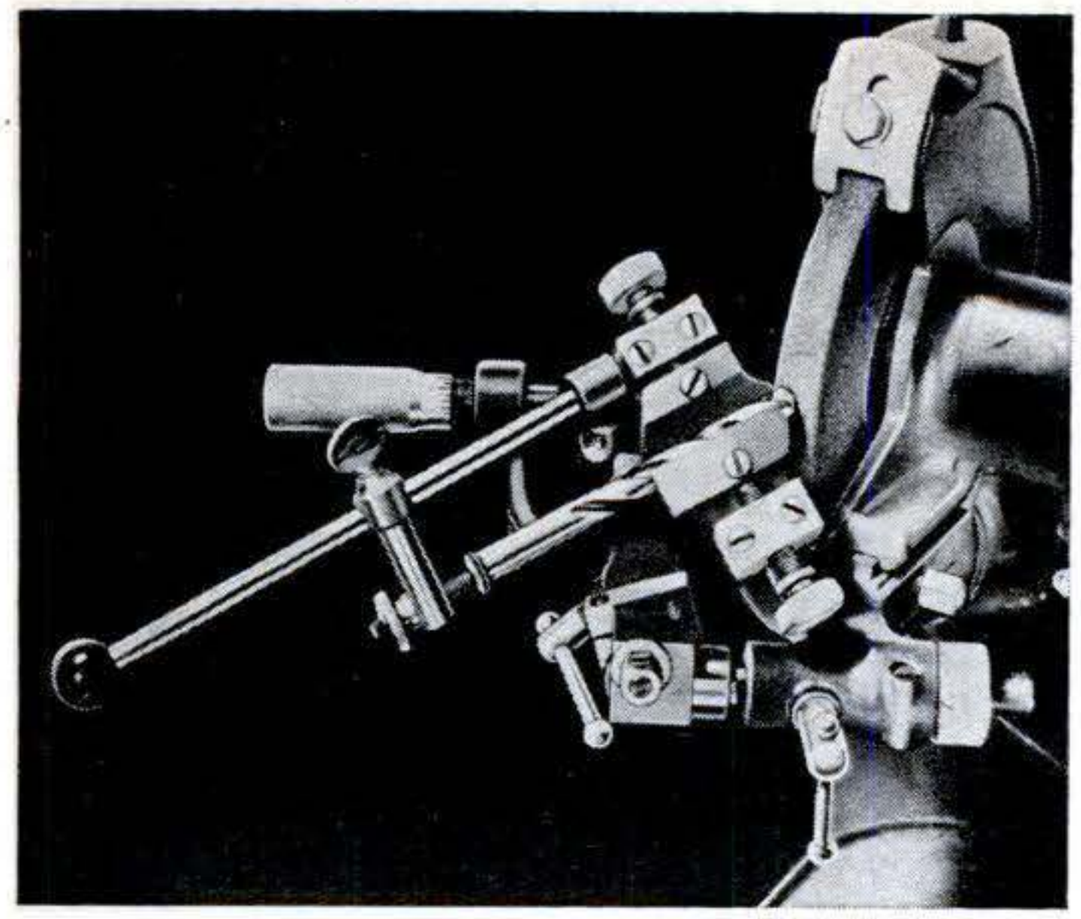
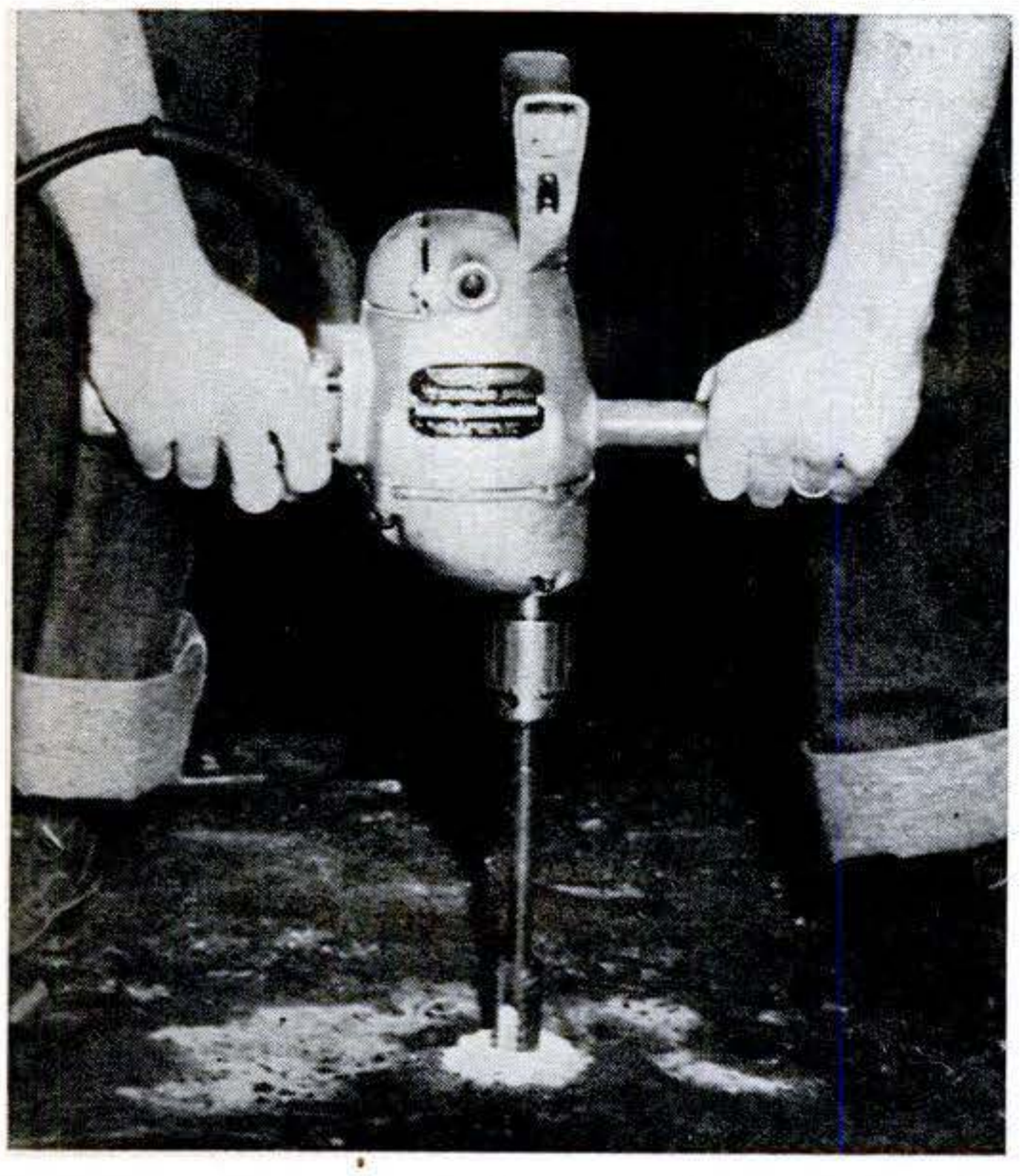
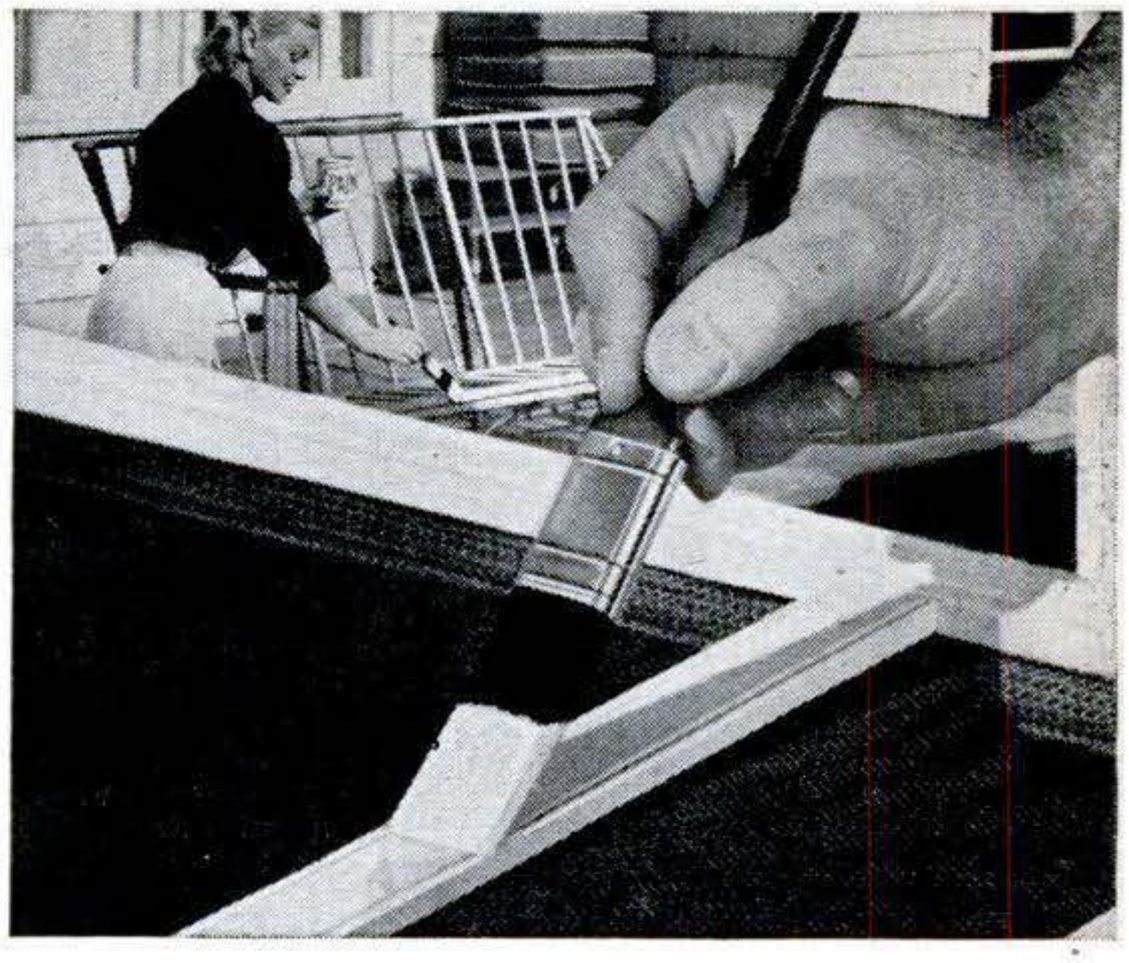


Attachment Sharpens Drills. Even an inexperienced operator can turn out perfect sharpening jobs on ⅛″ to ⅝″ drills with this tool. It's made by the Power Tool Div., Rockwell Mfg. Co., Milwaukee, for use with a standard tool grinder.

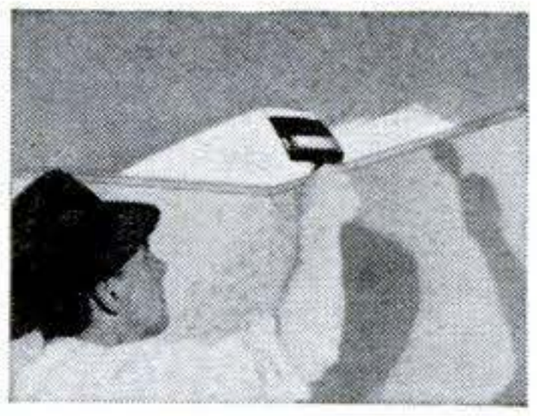


Drill Cuts Cores in Concrete. This rotary drill cuts only on the perimeter of the circle, allowing the core to go up inside the drill. The core is later removed through a core-exhaust slot in the side of the drill. Spiral grooves on the outside of the drill carry pulverized particles out of the hole. Carbide cutters on the end of the barrel do the cutting. According to the maker, the Tilden Tool Mfg. Co., of Pasadena, Calif., the drill can cut most concrete as fast as 6″ a minute. Drills are available in diameters from 3/16″ to 4″.

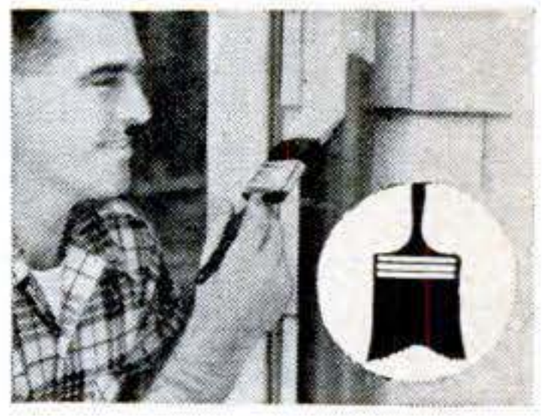
POINTERS FOR HOME PAINTERS



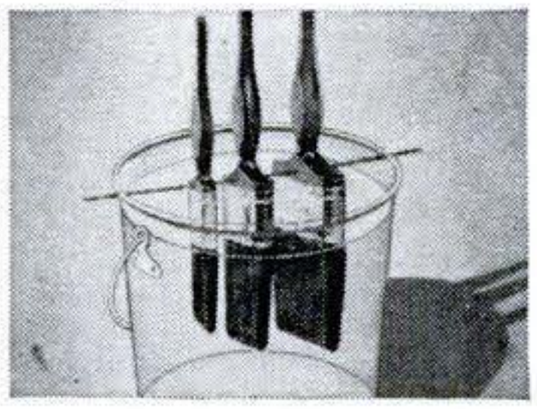
How to improve your paint jobs... make your brushes last longer



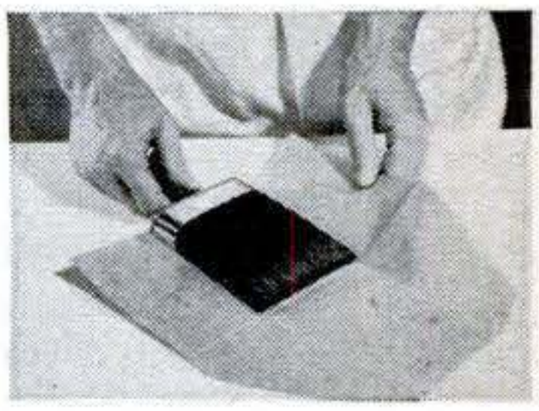
Start in corners of walls, ceilings and floors, and paint away from them. Use a strong stroke and work steadily so paint doesn't set before adjoining strip can be applied.



Don't let your brush "fish-tail" (see insert) by painting narrow or round surfaces with a large brush. Use small brush—one designed for the job—bristled with nylon.



Clean brushes with thinner after daily use. Suspend brush in thinner overnight. Bristle tips should not touch bottom of can. Work out thinner before painting again.



When you store brushes for longer periods, clean thoroughly and wrap securely in the manner shown here. Brushes stay in better condition when kept in shape.

For best results use NYLON PAINT BRUSHES

Job after job, you'll get best results with a nylon paint brush. Tests made by an independent research laboratory prove nylon brushes paint smoother. And durable Du Pont nylon bristles don't break off, even on roughest surfaces. They last 3 to 5 times longer than ordinary bristles . . . are clean and sanitary. Nylon paint brushes are made by leading manufacturers in all types and sizes. Look for the word NYLON on the handle.

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REG. U. S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

The best brushes have
DU PONT NYLON BRISTLES

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P.S. Last minute news & notes...

COLOR TV RECEIVERS made by CBS may be available to the public soon. With purchase of Hytron Co. and subsidiaries, CBS has moved into the manufacture of TV and radio tubes and sets . . . TINY TV TUBES, cigar-sized, will eventually replace today's giant direct-view tubes, electronics expert Philo T. Farnsworth predicts. The projected image will have screen brightness up to 50,000 times that of present tubes, he said.

YELLOW BIRD HOUSES scare away wrens, wild-life managers R. A. McCabe and R. S. Ellarson discovered. The wrens showed no special preference for red, green, white, or blue, but they didn't like yellow.

BATTERY FAILURES displaced tire troubles as main instigator of AAA service calls in 1950. Seems all the extra gadgets drain them. City drivers especially should check for full charge and keep terminals clean.

APPLE JUICE loses some of its aroma when it's concentrated for frozen packaging, so now they take out the aroma first, concentrate the juice, then put the flavor back in . . . APPLE-SCENTED insecticide DFDT, supposed to kill house flies better than DDT, is said by Dr. W. T. Sumerford of U.S. Public Health Service to be less toxic to warm-blooded animals.

SOLDERING GLASS to metal has been accomplished by GE engineers. Titanium hydride helps do the trick.

SIX SURVIVAL SECRETS in biological warfare. Three do's: Keep self and home clean; report sickness at once; give authorities all possible help. Three dont's: Don't rush outside right after a bombing; don't take a chance on food and water in open containers; don't start rumors or believe in wild stories.

DISCARD MILK given by cows getting penicillin for some days after end of treatment, U. of Missouri College of Agriculture advises dairymen. It may sensitize consumers and pass on penicillin-proof strains of infectious organisms.

JET AIRCRAFT efficiency is going up. In 1944 100 pounds of thrust took 19 gallons of fuel per hour. Today 16 gallons do it. Standard Oil predicts 11 will do the trick soon.

BRAIN TUMORS show up differently on a shadowgraph than surrounding brain tissue does when a skull is scanned with a beam of ultrasonic waves. This research by a cancer team of physicists and medical men should eliminate much exploratory surgery.

GOING, GOING . . . About 5 percent of the scientific and engineering population of the country is engaged in atomic energy work.

A PLYWOOD AUTOMOBILE has been introduced in Germany by Lloyd Motor works in Bremen. It delivers for about $700, has front-wheel drive, and is powered by a two-cylinder, two-cycle 60-hp. engine. Its body is covered with artificial leather.

WATER is a crystal network, Prof. Gerald J. Holton of Harvard has found. Only by squeezing it with pressures up to 180,000 pounds per square inch could he change its structure enough to make it react the way theory says a classical liquid should.

JUNIOR may soon get synthetic vitamin A, minus a fishy taste, right in his pablum instead of the daily dose of cod-liver oil. Difficult job of keeping it pure and stable in powder form (and as a liquid derivative) was overcome by scientists at Chas. Pfizer & Co.

MAGNETIC STORMS are keyed to planet positions, RCA radiowave analyst J. H. Nelson found.

The Editors

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"Live artist" quality is a characteristic of the new RCA Victor "Personal" radio, one of the most compact ever built.

How to hold a band in your hand!

Tune in this new RCA Victor "Personal" radio—no bigger than a book. From it pour the full tones of any orchestra—so full of "living presence"—that it's like holding a band in your hand.

This instrument grows directly from research at RCA Laboratories. Scientists and engineers here perfected highly efficient circuits and electron tubes—powered by miniature RCA Batteries. Its built-in antenna gives peak performance at home or "on the road." Its miniature loudspeaker offers fine acoustical performance in minimum space.

Development of this handsome portable radio, weighing less than 4 pounds, is another example of RCA research and engineering at work for you. Result: a totally new satisfaction from a small "Personal" radio.

* * *

See the latest wonders of radio, television and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20, N. Y.

For another example of how RCA Research works for you, see the new RCA Victor "Personal" radio today. Model B411—at your local RCA Victor dealer's.

RADIO CORPORATION of AMERICA

World Leader in Radio — First in Television

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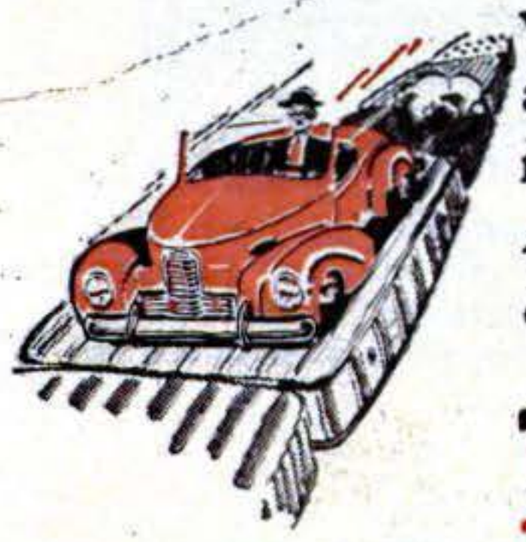
MARFAK MADE HIS CAR RIDE SO CUSHIONY HE'S SPOILED



Marfak chassis lubrication protects the chassis against wear and friction — far longer! It resists squeeze-out and wash-out — sticks to vital points for 1,000 miles or more. So *you* get a wonderful "cushiony" ride! Get *Marfak* lubrication today. See your Texaco Dealer, *the best friend your car ever had.*

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TEXACO DEALERS IN ALL 48 STATES

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TUNE IN . . TEXACO STAR THEATER starring MILTON BERLE on TV every Tuesday night. See newspaper for time and station.

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FRAN WARREN, *radio songstress.* "As a singer, I welcome Camel mildness. And Camels are such fun to smoke!"

"MY OWN 30-Day Test gave me a new pitch on cigarettes," says ace pitcher *Jim Konstanty.* "Camels hit the spot!"

STYLIST *Elaine Bassett:* "Ever since I made my own 30-day test, Camels are my favorite! They're so mild!"

PETER LIND HAYES, *comedian,* says: "Camels smoke cool and mild—they're just right for my throat!"

NADINE CONNER, *opera star·* "My own 30-Day Camel Test proved how much fun smoking can be!"

VAUGHN MONROE, *band leader:* "I enjoy every puff of a Camel! Camels taste great—and they're *mild!*"

TELEVISION STAR *Marguerite Piazza* agrees: "As a singer, I enjoy Camel mildness—and Camels taste grand!"

BASEBALL MANAGER *Ed Sawyer:* "Camels made a hit with me from the start. They're mild and taste great!"

More people smoke Camels than any other cigarette!

Make the 30-Day Camel MILDNESS Test—See why!

● No *other* cigarette can match Camel's rich, full flavor! And no *other* cigarette can offer you this *proof* of mildness:

In a coast-to-coast test of hundreds of men and women who smoked only Camels for 30 days, noted throat specialists, making weekly examinations, reported — *not one single case of throat irritation due to smoking Camels!*

Smoke Camels yourself for 30 days. Compare Camel's choice tobaccos for flavor *and* mildness... in your "T-Zone" (T for Throat, T for Taste). You'll see why so many smokers say...

ONCE A CAMEL SMOKER, ALWAYS A CAMEL SMOKER!

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

JOHN WAYNE, *movie hero,* says: "I found the cigarette I could enjoy as a steady smoke—Camels!"

KYLE MacDONNELL, *television star,* says: "Yes, I made my own 30-Day Camel Mildness Test. It was fun!"

OPERA STAR, *Robert Merrill:* "The cigarette I smoke must agree with my throat. Camels are really mild!"

RIFLE CHAMPION *Audrey Bockmann:* "Camels scored a hit with my taste, too! And they're mild!"

DICK POWELL, *movie star,* states: "Camels give me more pleasure than I ever got from any other cigarette!"

RISË STEVENS, *opera beauty,* says: "I know how mild Camels are! My own 30-Day Test convinced me!"

LECTURER AND WRITER *Dr. Archibald Rutledge:* "I've smoked Camels for years! They're cool and mild."

"I'M A SINGER and my throat comes first! I picked Camels as my steady smoke!" *Anne Jeffreys,* stage star.

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Now! YOU CAN MAKE MONEY...

TURNING WORTHLESS OBJECTS INTO VALUABLE TREASURES—

...BY CERAMIZING!

HERE ARE JUST A FEW OF THE HUNDREDS OF ARTICLES THAT CAN BE TRANSFORMED BY "CERAMIZING"—INCREASED IN VALUE—OR "ETERNALIZED" AS KEEPSAKES WITH A VARI-COLORED COATING THAT HAS THE APPEARANCE OF THE FINEST KILN FIRED CHINA

Costume Jewelry from flowers, leaves, nuts, and shells.

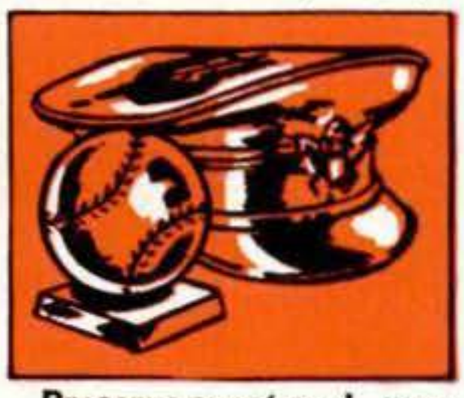
Paper Weights, Trays, and Objects of Art from Nature.

"Ceramized" Busts, Figures from plaster, or wood carvings.

"Ceramized" Objects of glass, leather, plastics, or rubber.

"Eternalize" baby shoes, toys, and other sentimental mementoes.

"Ceramize" Baskets, Plates, Trays, and other metal objects.



Preserve sport and war trophies in sparkling simulated china.

YES—ANY MAN OR WOMAN CAN DO WORK LIKE THIS IN ONE CORNER OF THE KITCHEN OR IN ANY SPARE ROOM!

A Satisfying New Home Art Hobby Pays Up To $5.00 AN HOUR for SPARE TIME

Amazing book tells you

HOW TO do the work - HOW TO get customers coming to you—HOW TO set up the simple equipment — HOW and where to buy the materials —what to charge—HOW TO start in spare time—HOW TO expand into a full time business whenever you wish. Shows you in pictures and words HOW TO put a hard "Ceramized" finish on such things as flowers, leaves, insects, shells, wood carvings, plaster castings, busts, statues, religious figures, buttons, baskets, feathers, baseballs, golf balls, mementoes of all kinds, such as baby shoes, party and wedding favors and decorations. Operating a home "Ceramizing" business is one of the greatest insurance policies a man could ask for his future. READ ABOUT IT WITHOUT RISKING A PENNY.

Think of turning 56 cents worth of materials into a profit of $5.00 for just a few minutes of easily learned handiwork. Think of beautifying your own home and amazing friends with the artistic skill you can master in less than an hour of study and practice. Sounds fantastic. Yet it's absolutely true . . . AS YOU CAN QUICKLY PROVE TO YOURSELF without risking even the cost of a stamp!

AN EXCITING NEW OPPORTUNITY FOR PLEASURE AND PROFIT

Just at a time when hundreds of men and women would like to make an extra $35.00 to $50.00 a week in spare time home work—just at a time when hundreds would like a new outlet for expressing their artistic skills—just at a time when the country is turning to a revival of appreciation of beautiful handcrafts, the fascinating new art of "Ceramizing" is ready for you. Every step of this process can be learned in less than an hour of home practice.

The process is so simple that even a child can learn it. No knowledge of art or drawing is required. No knowledge of proportion or design is needed. You work with objects already created, or with the countless thousands of Nature's beautiful forms. You coat the object itself with a hard finish that has the appearance of kiln fired, glazed china—and you apply a variety of colors. By following my simple instructions you can develop a deeply satisfying creative hobby—or you can use your hobby in spare time to make as much as $5.00 an hour. I even show you the easy way to get others to come to you for your products.

ALL THIS INFORMATION IS FREE

It doesn't even cost you a postage stamp to get the details of the exact plan by which hundreds are NOW MAKING EXTRA MONEY EVERY WEEK. Analyze the possibilities. Then if you don't think it's made to order for you —your only loss is your time. You can read every fact, every secret, every step of the instructions—all at my risk.

DOESN'T COST A PENNY...NO POSTAGE NEEDED

MAIL THIS CARD TO-DAY!

RAY E. BRANDELL, WARNER ELECTRIC CO., 1512 Jarvis Ave., Dept. 26, Chicago 26, Ill.

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